NERITA NO. 1, OFFSHORE VICTORIA

WELL COMPLETION REPORT

by

Shell Development (Australia) Pty. Limited.

Melbourne

December, 1967.

CONTENTS

APPENDICES

I. SUMMARY

(a) Drilling

Nerita 1 was drilled with the SEDCO 135E semi-submersible rig in floating position for the operator, Shell Development (Australia) Pty. Ltd.

Anchoring the SEDCO unit over the location did not require any pile drilling as in the previous location. Preliminary sea bottom investigation indicated that good (i.e. soft) anchoring ground would be present. However due to low shear strength of the bottom sediments evidenced during the first trials with the SEDCO's own 30,000 lbs anchors, numerous re-settings of the anchors had to be made, and additional back-up anchors (and in one case heavy chain) had to be added to obtain sufficient holding capacity. This proved time consuming, and when drilling started on 1st July 1967, the required 200,000 lbs test tension had not yet been obtained on all anchors.

From then on drilling proceeded uneventfully to a total depth of 6,700 ft bdf, reached on 30th July.

The Lower Cretaceous Otway group was plugged back without testing. Three different intervals were wire line tested in the Lower Tertiary and Upper Cretaceous section and found 100% water bearing.

The well was therefore plugged back and abandoned as a dry hole on 2nd August 1967 and, after rigging down and de-anchoring, the unit left for VOLUTA location on 17th August 1967.

(b) Geological

Nerita 1, the second well to be drilled offshore in the Otway Basin, was drilled as a test well on the culmination of a seismically defined structure 12 miles offshore in the Torquay Sub-basin. The well spudded in and drilled through a sequence of marine carbonates and marls of the Miocene - Upper Eocene Torquay group to 1180 feet, then penetrated the mainly marine silty clays of the Upper Eocene Demon's Bluff formation to 2091 feet and a section of continental sands, silty claystones and coal seams of the Upper Eocene Boonah formation to an unconformity at 2555 feet, the level of the seismic "B" horizon. Below this unconformity the well drilled through a mainly continental sequence of sands, sandstones, siltstones, claystones and coal of the Paleocene - Upper Cretaceous Eastern View Coal Measures to 4798 feet and continental sandstones, siltstones and shales of the Lower Cretaceous Otway group to a total depth of 6700 feet.

Only minor methane shows were recorded from the Eastern View Coal Measures and the Otway group.

Three Formation Interval Tests in sandstones with good reservoir properties of the Eastern View Coal Measures produced only fresh to brackish water and the well was abandoned as a dry hole.

II. INTRODUCTION

Nerita 1 is the second offshore exploration well in the Otway Basin in southern Victoria. It was drilled to test the hydrocarbon bearing potential of a seismically defined structure with an area of closure of approximately 15 square miles and a vertical closure of up to 350 feet, situated 12 miles offshore in the Torquay Sub-basin.

The Torquay Sub-basin constitutes the eastern part of the Otway Basin (see Locality map, Enclosure 1), which trends approximately E-W across the southern part of western Victoria, extending offshore onto the continental shelf.

During the Lower Cretaceous (and possibly Upper Jurassic) a thick sequence of first-cycle fluviatile sediments, sandstones, siltstones and shales of the Otway group, was deposited. At the end of the Lower Cretaceous, extensive fault movements accompanied by minor folding started to take place in the Otway Basin and the original E-W trough became divided into several embayments and sub-basins, one of which was the Torquay Sub-basin. Under conditions of continuing structural development during the Upper Cretaceous and Lower Tertiary the Sub-basin was filled with continental deltaic sandstones and sands interbedded with claystones, siltstones and coal, constituting the Eastern View Coal Measures and Boonah formation. The overlying shallow marine silty clays of the Upper Eocene Demon's Bluff formation record the beginning of a marine transgression, which during the Oligocene-Miocene invaded the whole Otway Basin and was accompanied by a change to predominant carbonate sedimentation.

The lithology of the sequence penetrated did not differ greatly from the prognosticated section. Although sandstones with reasonable reservoir properties were present as predicted no significant quantities of hydrocarbons were encountered and the well was plugged and abandoned at a total depth of 6700 feet.

III. WELL HISTORY

1. General Data

(a)	Well name and number:	NERITA No. 1
(b)	Name and address of Operator:	Shell Development (Aust.) Pty. Ltd., 155 William Street, Melbourne, Victoria, 3000.
(c)	Name and address of tenement holder:	Frome-Broken Hill Co. Pty. Ltd., 31 Queen Street, Melbourne, Victoria, 3000.
(d)	Petroleum tenement:	Authority to prospect PEP 22 Otway Basin, offshore Victoria. Shell Development is acting as operator on behalf of itself and Frome-Broken Hill Co. Pty. Ltd. The operating agreement dated 29th June 1965, between Frome-Broken Hill Co. Pty. Ltd. and Shell Development (Aust.) Pty. Ltd. was approved by the Minister for Mines, Victoria on 13th July 1965.
(e)	District:	Otway Basin, offshore Victoria.
(f)	Location:	I. Geographical Co-ordinates Long. 144° 13' 44.83" E Lat. 38° 37' 43.19" S II. ATM (Zone 7) Eastings 231346 yards Northings 236677 yards
(g)	Elevation: Reference for depth: Derrick floor elevation:	Seabed 245 feet below MSL. Derrick floor. 112 feet above MSL.
(h)	Total Depth:	6,700 ft bdf
(i)	Date drilling commenced:	1st July 1967
(j)	Date total depth reached:	30th July 1967
(k)	Date well abandoned:	2nd August 1967
(l)	Date rig was released:	17th August 1967
(m)	Drilling time to total depth:	30 days
(n)	Status of well:	Abandoned as dry hole with following plugs. Cement Plug No. 1 (first stage) 5,010- 4,000 ft bdf with 400 sacks class "E" cement. Cement Plug No. 1 (second stage) 4,000 - 2,900 ft bdf with 128 sacks class "E" cement and 272 sacks class "B" cement. BAKER Model "N" Bridge Plug at 2,806 ft bdf in $9\frac{5}{8}$" casing. Cement Plug No. 2 2,800 - 2,092 ft bdf with 250 sacks class "B" cement. BAKER Model "K" converted to Bridge Plug at 610 ft bdf in $9\frac{5}{8}$" casing. Cement Plug No. 3 600 - 370 ft bdf with 80 sacks class "B" cement. VETCO type temporary and permanent guide base left on sea bed.

(o) Total Cost: Nerita-1 $1,300,000

2. Drilling Data

(a) Name and address of Drilling Contractor: Southeastern Drilling Inc.,
4400 First National Bank Building,
Dallas, Texas, 75202, USA.

In Australia: 143 Percy Street,
Portland, Victoria, 3305.

(b) Drilling Plant: Plant owned by Southeastern Drilling Inc., of U.S.A.

Drawworks: Make: Oilwell
Type: E-3000 (electrically driven drawworks)

Power Units (Engine & Generators)

No.	Make	Model
3 (on skids)	Electro-Motive Division	SR-16"W

The skid mounted units comprised the following:

I. Engines

No.	Make	Model	HP
3	GM	16-645	2200 each @ 857 RPM.

II. Generators

Power Unit No. I

One 1500 KW DC generator
Two D-79 DC generators 553 KW each

Power Unit No. II and III

One 1500 KW-DC generator
One D-79 DC generator 553 KW
One 750 KW AC alternator

Auxiliary Units

One Cat. D-353 engine driven
250 KW, AC alternator

Horse Power

Available to Drawworks - 1600 HP.

Drill Pipe

Size (in.)	:	5 Range 2
Tool Joint (in.)	:	$6\frac{3}{8}$ - OD
Connection type	:	5" XH
Weight lb/ft	:	19.5
Grade	:	E
Length (ft)	:	12,000

Drill Collars

Size O.D. (in.)	:	$9\frac{1}{2}$	8	$6\frac{1}{2}$
I.D. (in.)	:	2-13/16	2/13/16	2-13/16
Connection (type)	:	$7\frac{5}{8}$ API Reg.	$6\frac{5}{8}$ API Reg.	API No. 46 IF(4"IF)
Weight lbs/ft	:	220	150	92
Number	:	6	30	40

Core Barrel

Make	:	Christensen
Model	:	250-P
Length	:	$6\frac{3}{4}$ x 4 x 60'
Number	:	One

(c) Mast : Make: Lee C. Moore
Type: Cantilever offshore mast-welded type.
Gross Capacity: 1,333,000 lbs
Static hook capacity: 1,000,000 lbs

(d) Slush Pumps:

No.	Make	Type	Size
2	Oilwell	1700-P	7" x 18"
2	Mission	Centrifugal	5 x 6R

All electrically driven (see Power Units above).

(e) Blowout Preventor Stacks:

1. 20" (Nom.) BOP's - comprising the following FROM TOP TO BOTTOM:-

(i) One inverted VETCO H-4 - 20¾" hydraulic connector.

(ii) One VETCO 24" breach lock flex joint for a maximum of 9 degrees deflection.

(iii) One Hydril MSP 2000 psi.

(iv) One Cameron 20" nominal drilling spool with one studded 3-1/16" 10,000 lbs test outlet.

(v) One VETCO H-4 - 20¾" hydraulic connector.

2. 13" BOP's comprising the following from top to bottom

(i) One inverted VETCO H-4 13⅝" hydraulic connector.

(ii) One VETCO 16" breach lock flex joint (allowing a maximum deflection of 9°).

(iii) One Hydril GK-5,000 psi W.P.

(iv) Two double Cameron U-type preventors with ram locks, each with 2 studded outlets 10,000 psi. test, 3-1/16" I.D.

(v) One VETCO H-4, 13⅝" hydraulic connector.

(f) Hole size and depth (bdf)
36 inch to 470 feet
26 inch to 629 feet
17½ inch to 1,305 feet
12¼ inch to 3,226 feet
8½ inch to 6,700 feet

(g) Casing and Cementing details:

Size (in)	30	20	13⅜	9⅝
Weight (lbs/ft)	310	94	72	47/43.5
Grade	-	H 40	N 80	P110/N 80
Range	3	2 - 3	2	2
Setting depth (ft/bdf)	462	618	1,295	3,216
Shoe/Collar	Float/-	Flexi Flow	Guide/Diff Fillup	Diff Fillu Shoe & Col
Plugs	-	-	Top & Bott.	Top & Bott
Centralisers	-	-	4	14
Cement (sacks)	1,280	680	630	730
TOC annulus (ft/bdf)	sea bed	sea bed	500 (CBL)	1,000 (CBL
Method used	Displacement	Displacement	Plugs	Plugs

(h) Drilling Fluid:

Nerita was spudded in with seawater and seawater was used for drilling, without marine riser to 629 ft, where the 20" casing was set. Before running 30" and 20" casing 66 lbs/cuft Bentonite mud was spotted in the hole.
Spersene - XP 20 inhibited mud was used below the 20" casing. The treatment was increased with depth to obtain the required properties. The following are the average weekly characteristics of the mud used in Nerita 1:

Week No	Weight lbs/cuft	Viscosity MF-sec	Filtrate cc/30min	Sand %	Silt %	p_H	Cl^1 ppm
1	66	56	8.0	NA	NA	NA	NA
2	69	40	6.0	0.6	1.0	9.6	1900
3	71	41	4.8	0.5	2.5	9.8	1750
4	74	43	4.8	0.8	4.0	9.8	1850

(i) Water Supply:

Fresh water for industrial purposes was transported from Portland's main water supply system to the drilling barge on the two work boats. Both boats have a fresh water storage capacity of approximately 250 tons each. The drinking water was distilled on board.

(j) Perforation and Shooting Record:

Not applicable.

(k) Plugging back and Squeeze Cementation Jobs:

Abandonment plugs as agreed to by the Victorian Mines Department were as follows:

	Bridge Plug No. 1	Bridge Plug No.2
Type of plug :	Baker Model "N"	Baker Model "K" converted to BP
Size :	6 A A	6 A A
Depth :	2806 ft	610 ft
Method used :	Set on wire line	Set on wire line
Plug Tested :	No	No
	Cement Plug No. 1 (first stage)	Cement Plug No. 1 (second stage)
Length	1000 ft	1100 ft
Type of plug	Class E Cement	Class E/Construction Cement
Number of sacks used	400	128/272
Depth interval plugged (bdf)	5010' - 4010'	4000' - 2900'
Method used	1600 ft open ended $2\frac{7}{8}$"	TBG on 5" Dp
Squeeze pressure	None	None
Amount squeezed	Nil	Nil
Plug tested	No	No

		Cement Plug No. 2	Cement Plug No. 3
Length	:	708	230
Type of plug	:	Construction cement	Construction cement
Number of sacks used	:	250	80
Depth interval plugged (bdf)	:	2800 - 2092	600 - 370
Method used	:	800ft open ended $2\frac{7}{8}$" Tbg on 5" DP	600ft $2\frac{7}{8}$" Tbg
Squeeze pressure	:	None	None
Amount Squeezed	:	Nil	Nil
Plug tested	:	No	No

(l) Fishing Operations

None

(m) Side-tracked hole:

None

3. Logging and Testing

(a) Ditch cuttings:

Samples were collected in Nerita 1 from 629 ft on, at ten feet intervals during drilling. All samples were taken from the shale shaker. Time lag checks were made at frequent intervals. The ditch cutting samples were washed, dried and split into portions, which were placed in separate marked envelopes. Complete sets of these samples are stored in the Core Laboratories of the Victorian Mines Department, the Core and Cutting Laboratory BMR, and in the Geological Laboratory, Shell Development (Australia) Pty. Ltd., Melbourne.

(b) Coring:

None.

(c) Side Wall Cores:

Prior to running and cementing the $9\frac{5}{8}$" casing and after reaching total depth, Schlumberger shot a total of 90 side wall cores of which 73 were accepted by the wellsite geologist.

Listed below are the depths at which these side wall cores were taken:

Depth (ft)	Remarks	Depth (ft)	Remarks
1382		3768	Not accepted
1545		3830	
1774	Misfire	3867	
2035		3880	
2106		3908	
2156		3978	
2208		3986	
2270		4015	
2295		4065	
2327		4191	
2496		4245	Not accepted
2533		4290	Empty
2570		4372	
2614		4439	Lost
2682		4460	
2712		4534	
2816		4628	
2846		4640	Empty

Depth (ft)	Remarks	Depth (ft)	Remarks
2884		4660	
2931		4776	
2954		4782	Not accepted
2964		4804	
2989		4860	Lost
3001		4944	
3048		5068	
3084		5225	
3107		5287	
3149		5327	
3155		5475	
3215		5522	
3230	Empty	5561	
3253		5612	
3325	Empty	5700	
3333		5772	Not accepted
3434	Not accepted	5875	Not accepted
3468		5900	
3531		5928	Not accepted
3570		5982	
3587	Not accepted	6068	
3666		6285	
3680	Empty	6350	
3700		6394	
3704		6456	
3758		6544	
		6598	Not accepted
		6645	

(d) Electric and other Logging - Summary

The several types and runs of Schlumberger logs recorded in NERITA -1 are listed in Appendix I and presented graphically in Appendix IA; the calculations carried out at the levels of interest are presented in Appendix II.

The conclusions of general interest are summarized below:

(i) The main sand section, from 2400 ft to 4798 ft bdf (Paleocene-Upper Cretaceous) is characterised by a gradual and continuous downward increase in formation water salinity from ca 2,000 to ca 15,000 ppm Na Cl. Log-derived porosities range from 21% to 31%. All sands were found to be 100% water saturated.

(ii) The Lower Cretaceous Otway group shows very little SP development throughout, very likely due to almost complete lack of permeability. In this interval the resistivity increases with depth as a result of a decrease in porosity (from ca? 25% to less than 10%). The formation water salinity appears to follow approximately the same trend as in the Upper Cretaceous and reaches an estimated 25,000 ppm Na Cl at 6,700 ft bdf. All sands are practically 100% water bearing.

(e) Penetration Rate Log:

A Penetration Rate Log(drilling time log) is included in the Composite Well Log (Encl.3) and in the Well History Chart (Encl.4).

(f) Deviation Surveys:

A total of 19 drift surveys were carried out in this hole (Appendix III). The Totco Double Recorder for measuring drift up to 8° was used.

(g) Temperature Surveys:

None.

(h) Gas Log:

A continuous mud gas recorder and a gas chromatograph were used to record and analyse gas shows from the mud. The Mud Gas Log is included in the Composite Well Log (Encl.3).

(i) Formation Testing

Schlumberger Well Surveying Corp. conducted all tests carried out in this well, using Schlumberger's FIT/FTT open hole/through casing tester. Details and results of the tests are listed below:

Formation Test No.	:	1
Set at	:	3670 ft
Depth reference	:	IES run No. 3
Test attempted in	:	Open hole
Equipment used	:	Schlumberger FTT
Test Result	:	--
Remarks	:	Flowline valve failed to open, no recovery.
Formation Test No.	:	2
Set at	:	3670 ft
Depth reference	:	IES run No. 3
Test attempted in	:	Open hole
Equipment used	:	Schlumberger FIT
Test result	:	Recovered 20 litre water and 0.2 litre mud
Remarks	:	None
Formation Test No.	:	3
Set at	:	4777 ft
Depth reference	:	IES run No. 3
Test attempted in	:	Open hole
Equipment used	:	Schlumberger FIT
Test results	:	Recovered 20 litre water
Remarks	:	None
Formation Test No.	:	4
Set at	:	2404 ft
Depth reference	:	IES run No. 2
Test attempted in	:	Cased hole. $9\frac{5}{8}$" casing
Equipment used	:	Schlumberger FIT
Test result	:	Recovered 5 litre water
Remarks	:	Flowline valve failed to close properly

(j) Production Testing:

None

IV. GEOLOGY

1. History of Exploration

The search for hydrocarbons has been carried out in the Otway Basin for many years and several companies hold exploration permits granted by the Victorian and South Australian Governments. The work of these companies, supported by the B.M.R. and State Mines Departments has contributed greatly to an understanding of the basin and its petroleum prospects. A number of hydrocarbon indications has been reported but as yet no commercial accumulation has been proved.

In addition to surface and sub-surface geological work, aeromagnetic and gravity surveys have been carried out in various parts of the basin and an extensive seismic coverage exists both onshore and offshore. Up to July 1967 a total of 24 onshore petroleum exploration wells had been drilled in the Otway Basin, 10 of which had been drilled by Frome-Broken Hill, mainly in the Port Campbell area.

Following a farm-in agreement dated 13th July, 1965 Shell Development (Australia) Pty. Ltd. became operator in Petroleum Exploration Permits 5, 6 and 22 (Encl.1) with the right to earn a 50% interest for a total expenditure of $A4,000,000 including seismic and drilling operations. During 1966 land seismic surveys were completed in the Yambuk, Portland and Nelson areas and two marine seismic surveys were carried out in P.E.P. 22. A structure located offshore in the Port Campbell embayment was tested by the first offshore well in the Otway Basin, S.D.A.'s Pecten 1A well, during March-June 1967, but proved to be dry.

A structural high defined by marine seismic coverage in the Torquay Sub-basin was the location of Nerita -1, the second offshore well to be drilled in the Otway Basin.

2. Summary of Regional Geology

(a) Stratigraphy

The Otway Basin was the depositional area for a sequence of (?) Jurassic - Tertiary sediments, trending east-west across southwestern Victoria, almost at right angles to the predominating N-S trend of the underlying Palaeozoic rocks of the Tasman Geosyncline.

During the (?) Jurassic - Lower Cretaceous the basin was a single large trough, probably connected to the Gippsland Basin, in which a monotonous sequence of continental fluviatile sandstones, siltstones and shales of the Otway group was deposited. The Otway group rocks are first-cycle type, immature sediments containing a high proportion of lithic and feldspathic debris. It is considered that the sediment was derived from both northern and southern sources. Basal conglomerate and some clean quartz sands have been found in the Otway group, but appear to be restricted to the northern margin of the Tyrendarra Embayment. Correlations of several sandy members within the Otway group have been attempted, but only a broad lithological sub-division into two units is possible, unit 2 containing more shales and clayey material than the overlying unit 1.

After deposition of the Otway group, block faulting accompanied by some warping resulted in the division of the Otway Basin into several sub-basins and embayments; from west to east, the Gambier Sub-basin, the Tyrendarra and Port Campbell Embayments and the Torquay and Port Phillip Sub-basins. The latter two in particular appear to have remained separate from the rest of the Otway Basin during the Upper Cretaceous and Paleocene.

The drilling of Nerita -1 has shown that the central part of the Torquay Sub-basin has been filled with a continuous Upper Cretaceous - Paleocene sedimentary sequence, the Eastern View Coal Measures, without any apparent break in sedimentation. This sequence unconformably overlies the rocks of the Otway group. Onshore, near the north-western margin of the sub-basin, no Upper Cretaceous is present and the Otway group is unconformably overlain by a clastic sequence of Paleocene age (Ref.No.1). Thus Upper Cretaceous sediments appear to be restricted to the central part of the basin wedging out towards the north-western margin. No Upper Cretaceous is known from surface outcrops, but several hundred feet of probable Upper Cretaceous are present in Anglesea -1 well.

In Nerita -1 the Eastern View Coal Measures were found to be unconformably overlain by a sequence of similar lithology, sands, silty clay (stones) and coal seams, designated the Upper Eocene Boonah formation. The unconformity at the base of this formation, which occurs at the level of the seismic "B" horizon, is apparent from a break in the palynological sequence and from truncation of underlying layers against the "B" horizon. Seismic evidence points to a basin-wide occurrence of this Paleocene - Upper Eocene unconformity in the Torquay Sub-basin.

The Boonah formation is overlain by the silty clays of the Upper Eocene Demon's Bluff formation, which gradually changes from paralic at the base to a marine facies in the upper part. The marine clays mark the beginning of a transgression which invades both the Otway and Gippsland Basins resulting in a widespread deposition of marls and carbonate rocks during the Oligocene and Miocene. In the Torquay Sub-basin this marine carbonate facies is represented by the Torquay group, an approximate equivalent of the Heytesbury group in the rest of the Otway Basin. It consists mainly of marine marls and, locally, sandy limestones.

(b) Structural Geology

The Otway Basin developed as part of an east-west trending zone of structural weakness across the southern end of the Palaeozoic Tasman Geosyncline and provided a depositional area for a great thickness of Lower Cretaceous sediments, the Otway group, which locally reaches more than 20,000 feet. Intensive faulting accompanied by local warping of sediments over structural highs started to take place at the end of the Lower Cretaceous and the Otway Basin became divided into sub-basins and embayments separated by structurally high blocks which are transverse to the trend of the Basin.

The Torquay Sub-basin, largely situated offshore, is essentially a graben-like feature between north-east trending uplifts, the Otway Range Uplift to the north-west and the King Island - Mornington Ridge to the south-east. Both uplifts remained structurally positive elements and greatly influenced the post-Lower Cretaceous evolution of the Sub-basin. During its geological history the Sub-basin was closed to the north. A structural high area bounding the Sub-basin in the south-west may have closed it during the earlier stages of its development, but did not prevent a marine invasion in the late Tertiary. In the central part of the Sub-basin a high ridge developed, apparently a south-west trending spur of the Bellarine High (Encl.1).

A detailed seismic reflection survey has outlined two pronounced anticlinal structures, the southern-most of which has been tested by Nerita -1. Both structures are situated along the mid-basin ridge which is bordered at both sides by deep troughs. The south-eastern trough is very deep and a post-Otway group sequence in excess of 10,000 feet may be present. A major fault and flexure zone separates the north-western trough from the Otway Range Uplift. The broad and gently folded structures are probably the result of warping of strata over structurally high blocks. Seismic records show all strata to be folded and a sparker survey over the Nerita structure confirmed that the anticlinal structure is still present in the Lower Miocene strata outcropping at the seabed. A slight angular unconformity at the top of the Eastern View Coal Measures in Nerita -1 indicates an initial structural development prior to the main post-Lower Miocene deformation.

3. Stratigraphic Table: Nerita -1

Age	Rock Unit	Top (Ft. below D.F.)	Thickness (Ft.)
Upper Eocene-Lower Miocene	Torquay Group	Seabed	823 +
Upper Eocene	Demon's Bluff formation	1180	911
Upper Eocene	Boonah formation	2091	464
	.....unconformity.....		
Upper Cretaceous-Paleocene	Eastern View C.M.	2555	2243
	.....unconformity.....		
Lower Cretaceous	Otway group	4798	1902 +
	T.D.	6700	

4. Stratigraphy - Nerita No.1

(a) General

Because of the lack of stratigraphic information on the offshore part of the Torquay Sub-basin prior to drilling Nerita -1, the lithological units described in the predicted section for the well (Encl.2) were, for simplicity, considered as equivalents of the major units in the rest of the Otway Basin. However, after drilling the well, it was clear that the Upper Cretaceous and lower Tertiary section in the offshore part of the Torquay Sub-basin was basically different from that in the rest of the Otway Basin, and in fact shows greater similarity to the Gippsland sequence. In particular, the Upper Cretaceous and lower Tertiary transgressive - regressive cycles in the Port Campbell Embayment are absent in the Torquay Sub-basin, and the Eastern View Coal Measures have no lithological counterpart in the Port Campbell Embayment. Therefore the stratigraphy of the section in Nerita -1 is based on the local nomenclature defined by Raggatt and Crespin (Ref.No.1) in coastal exposures of the Lower Cretaceous and Tertiary along the western margin of the Sub-basin; the only probable Upper Cretaceous previously known in the Sub-basin was penetrated in Anglesea-1. A correlation from Anglesea-1 to Nerita -1 is given in Encl.5.

The Upper Eocene to Lower Miocene carbonate sequence between the seafloor and 1180' in Nerita -1 is assigned to the Torquay group; the Lower Miocene marl outcropping on the sea floor is referred to the Puebla formation. The Oligocene - Upper Eocene limestones and marls below 618' (below which depth cuttings were obtained) belong to the Jan Juc formation, the limestone above 746' being considered as part of the Point Addis Limestone Member. The Torquay group, a carbonate sequence deposited during the last transgression in the area, is correlated with the Heytesbury group in the remainder of the Otway Basin.

The top of the Upper Eocene Demon's Bluff formation at 1180' is defined by a change from the carbonates of the Torquay group to siliciclastic sediments. The formation consists of interbedded silty clays and claystones, shale, quartz sand and dolomite streaks, and conformably overlies the silty quartz sands of the Boonah formation. The base of the Demon's Bluff formation (at 2091') is well defined by the Gamma Ray and Micrologs (Encl.3). The monotonous silty clay/claystone sequence between 1278' and 2091' is correlated with the Anglesea Siltstone member, but the overlying interval cannot be lithologically correlated with either the Angahook member or the Addiscott Greywacke member described by Raggatt and Crespin (Ref.No.1).

The Boonah Sandstone has been renamed the Boonah formation since it is evident in Nerita -1 that the unit contains significant beds of claystone and coal. The base of this Upper Eocene unit is defined by a slight angular unconformity which occurs at the seismic B-Horizon. A gap between the Paleocene and the Upper Eocene in the palynological sequence and a slight change in electrical log character confirm the unconformity at this level. The underlying continental sequence of quartz sand, conglomerate, claystone, silt, siltstone, dolomite and coal is correlated with the Eastern View Coal Measures. The sequence ranges in age from Upper Cretaceous to Paleocene and appears to be a result of continuous sedimentation during this time. The Eastern View Coal Measures more closely resemble the Upper Cretaceous - Paleocene Latrobe Deltaic Complex in the Gippsland Basin, than the Sherbrook group in the western parts of the Otway Basin.

The Eastern View Coal Measures unconformably overly the Lower Cretaceous Otway group, which, as elsewhere in the Otway Basin, proved to be a fairly monotonous sequence of interbedded lithic sandstones, siltstones, and claystone of fluviatile origin.

(b) Lithological description (depths in feet, below derrick floor)

(i) Torquay group (Upper Eocene - Lower Miocene).

357' (sea floor) - ? , Puebla formation (Lower Miocene):
Marl, silty, grey, with abundant fine calcareous organic debris (from 4'10" core taken in the sea-bottom).

618'-1180' * Jan Juc formation (Middle & Lower Oligocene and Upper Eocene)

618'-746' * Point Addis Limestone Member:
Bioclastic lime Packstone**, compact, beige to orange, locally pinkish, or grey brownish, medium grained, occasionally crystalline, very hard, slightly ferruginous, few coarse quartz grains or greenish volcanic clasts, very fossiliferous (debris of Lamellibranchs, Gastropods, Echinoids).
Very few marly or clayey streaks.

746'-851' Marl alternating with bioclastic lime Packstone
Marl, grey, containing abundant fine bioclasts and shell debris (Lamellibranchs, Gastropods, Echinoids, Foraminifera).
Bioclastic lime Packstone, as interval 618'-746'.

* Above 618' cuttings were not obtained.

** Carbonate rocks nomenclature is based on Dunham's classification (Reference No.5).

851'-976' Bioclastic lime Grainstone to Packstone interbedded with bioclastic lime wackestone and quartz Sand, and minor Marl. Bioclastic lime Grainstone, whitish, medium grained, loose to well consolidated, slightly to moderately sandy, very glauconitic, rare Pyrite, grading downwards into bioclastic lime Packstone, friable.

Subordinate bioclastic lime Wackestone, dark grey to grey, friable, slightly clayey and glauconitic, with abundant fine bioclasts. In lower 40 feet, interbedded with quartz Sand in loose grains, clear, medium to locally coarse grained, moderately sorted, sub-rounded, low sphericity.

Minor Marl intercalations, as interval 746'-851'.

976'-1180' Marl interbedded with Wackestone and Packstone.
Marl, as interval 746'-851', locally shaly and silty.
Bioclastic lime Wackestone, grey to light brown, friable to consolidated, glauconitic (except in lower 60 feet), locally slightly silty, grading into Marl.

Bioclastic lime Packstone, tight, whitish, consolidated, occasionally very glauconitic, as interval 851'-976'.

(ii) Demon's Bluff formation (Upper Eocene)

1180'-1278' Quartz Sand, with intercalations of Clay and streaks of Dolomite.

Quartz Sand, in loose grains, clear, coarse to very coarse grained, subrounded, low sphericity, clayey in lower 30 feet.
Few intercalations of Clay, dark grey to brownish, slightly silty and ferruginous (limonite).
Rare streaks of dolomitic Packstone, reddish to light brown, medium grained, crystalline, hard, sandy, some Glauconite. Siderite?

1278'-2091' Anglesea Siltstone member: Clay(and Claystone approximately below 1800'), dark grey to brownish in upper 50 feet, usually dark brown, plastic, earthy, silty, very silty in circa 1470'-1590' and 1800'-2010' intervals, moderately sandy down to 1470', slightly ferruginous (limonite), very thin silty or sandy streaks.

Shale, (between 2082' and 2091'), brown reddish, very silty, sandy, slightly glauconitic and pyritic.

(iii) Boonah formation (Upper Eocene)

2091'-2355' Quartz Sand interbedded with Claystone, and few streaks of Dolomite and Coal.

Quartz Sand, in loose grains, clear to whitish, very coarse to locally coarse grained, to fine grained in upper 30 feet, moderately sorted to locally well sorted, rounded to angular, low sphericity, locally clayey matrix, occasionally abundant pyrite grains.

Claystone, dark brown, sandy, silty to very silty, carbonaceous material, pyritic, locally slightly glauconitic. Few streaks of Dolomite, brown-beige, crystalline, sandy, glauconitic, below 2150' grading into dolomitic quartz Sandstone, dense, pinkish or greenish, consolidated, dolomitic to quartzitic cement.
Two intercalations (at 2095' and 2200') of Coal, black, dense, light, conchoidal fracture.

2355'-2555' Quartz Sand interbedded with Coal and some streaks of Clay.
Quartz Sand, in loose grains, clear to white, very coarse to locally granular and pebbly, clayey matrix, rare calcitic cement, as interval 2091'-2355'. Mostly in upper 100 feet interbedded with seams of Coal, black, dense, grading locally into silty Claystone/clayey Silt, dark brown to black, with abundant carbonaceous materials.

From 2355' to 2375', 2 layers of Clay, as interval 1278'-2082'.

At circa 2450', 2 streaks of Clay, whitish.

(iv) Eastern View Coal Measures (Upper Cretaceous-Paleocene)

2555'-2838' Quartz Sand/Conglomerate interbedded with Coal and Claystone, with very rare streaks of dolomitic Sandstone.

Quartz Sand, in loose grains, clear to white, generally very coarse to granular, locally clayey matrix, as interval 2051'-2355'; usually very conglomeratic (granular to pebbly) below 2680'. Locally grading into

Quartz Conglomerate, in loose grains, clear to white, granular to pebbly, well sorted, subangular, low sphericity.
Many seams of Coal, black, dense, grading into

Claystone, dark brown to black, interlaminated with abundant carbonaceous material, very silty, locally ferruginous, grading into

Silt to Siltstone, very clayey, dark brown to black, fissile, friable, abundant carbonaceous material.
Some intercalations (mainly from 2570' to 2650') of Clay, whitish or light grey to creamish, becoming beige-pinkish downwards, silty.

Very rare streaks of quartz Sandstone, dense, whitish to light brown, fine to medium grained, calcitic to calcidolomitic cement locally very abundant, consolidated.

2838'-3010' Quartz Sand interbedded with Claystone; some Siltstone intercalations and few Coal seams.

Quartz Sand, in loose grains, whitish, locally light reddish (limonite), coarse to very coarse grained, rarely granular, moderately sorted, subrounded to angular, low sphericity, clayey matrix in places, particularly in lower 100 ft., very abundant pyrite grains in lower 30 feet.

Claystone, beige-pinkish, very silty.

Siltstone, dense, dark green, hard.

Coal seams, as above.

3010'-3075' Dolomite/dolomitic Siltstone interbedded with quartz Sand and some intercalations of Siltstone and Claystone.
Dolomite, dense, white to light grey, microcrystalline, very silty, very hard, occasionally silicified, grading into Dolomitic Siltstone, very dense, whitish, abundant quartzitic to dolomitic cement, very hard.

Quartz Sand, Claystone and rare Coal seams, as interval 2838'-3010'.

3075'-3228' Claystone, interbedded with quartz Sand.

Claystone, beige-pinkish, dense, silty and sandy, in lower part.

Quartz Sand, as interval 2838'-3010'.
Few streaks of Dolomite, dense, brownish, sandy.

Rare Coal seams, as above.

3228'-3396' Dolomite/dolomitic Sandstone/dolomitic Siltstone, with some quartz Sand and Claystone intercalations and few Coal seams in lower 30 feet.

Dolomite, very dense, grey to light brown to reddish, locally silicified, microcrystalline to crystalline, medium grained, very hard, very silty, sandy, pyritic, (partly Siderite or Ankerite?) grading into dolomitic Siltstone, very dense, grey, locally pinkish, abundant dolomitic quartzitic cement, very hard, sandy, micaceous, and grading into

dolomitic quartz Sandstone, dense, whitish to light brown, medium to very fine grained, fairly sorted, angular, abundant dolomitic cement, very hard.

Quartz Sand, in loose or locally interlocked grains, very coarse to granular, as interval 2838'-3010'. In lower 60 feet Claystone, dark brown, silty, abundant carbonaceous material, often grading into Coal.

Coal, as above.

3396'-3688' Quartz Sand interbedded with Coal/Carbonaceous Claystone, and with Claystone in middle part. Some Siltstone intercalations. Quartz Sand, in loose grains, very coarse and locally granular grained in upper part, well sorted, subangular to subrounded, low sphericity, some clayey matrix in lower part, locally with Pyrite and Amber grains.

Coal and carbonaceous Claystone, as interval 3228'-3396'.

Claystone, brown-grey, friable, fissile.

Carbonaceous Siltstone, brown beige, soft, friable, clayey, very carbonaceous, micaceous.
Rare streaks of dolomitic Siltstone, whitish-beige, as interval 3228'-3396'.

In lower 50 feet, quartz to sublithic Sandstone, moderately porous, whitish to light grey or light green, medium to fine grained, moderately sorted, angular, low sphericity, pelitic dolomitic cement, friable to consolidated, micaceous, and streaks of quartz Sandstone, slightly porous, whitish to light grey, medium to fine grained, moderately sorted, angular, dolomitic to slightly quartzitic cement, consolidated to very consolidated, micaceous, few carbonaceous specks.

3688'-4102' Quartz Sandstone interbedded with subordinate Coal and carbonaceous Claystone. In lower 100 ft., some Siltstone intercalations.

Quartz Sandstone, in partly loose and partly slightly interlocked grains, usually moderately porous, whitish to clear.

4645'-4798' Quartz Sandstone, with subordinate carbonaceous

Siltstone in upper part.

Quartz Sandstone, broken up in loose grains, clear to whitish, coarse to very coarse grained, locally granular and pebbly, poor sorting, subrounded, moderate sphericity.

Few streaks of Claystone, as interval 4362'-4645', but partly sideritic.
In upper 50 feet, intercalations of carbonaceous Siltstone, grey brown, clayey, abundant carbonaceous material, very fine sandy laminae.

4102'-4362' Quartz Sandstone with little Claystone.
Quartz Sandstone, as interval 3688'-4102'. Few streaks of Claystone, light grey-brownish, silty and few intercalations of carbonaceous Claystone, black, silty, abundant carbonaceous material.
Rare Coal seams, as above.

4362'-4645' Carbonaceous Claystone interbedded with subordinate quartz Sandstone.

Carbonaceous Claystone, light grey brown, silty, abundant carbonaceous material, micaceous, locally grading into carbonaceous Siltstone, as interval 3396'-3688'.

Quartz Sandstone, as interval 3688'-4102' and quartz to sublithic Sandstone, dense, light grey to light pink, very fine grained, fairly sorted, subangular, dolomitic cement, some Feldspar(?) and in lower part, light grey, medium to fine grained, dolomitic and zeolitic cement, locally, clayey cement in central part, some Chlorite, Zeolite, Chert and locally abundant Pyrite.

Rare Coal seams, as above.

4645'-4798' Quartz Sandstone, with subordinate carbonaceous.

Siltstone in upper part.

Quartz Sandstone, broken up in loose grains, clear to whitish, coarse to very coarse grained, locally granular and pebbly, poor sorting, subrounded, moderate sphericity.

Few streaks of Claystone, as interval 4362'-4645', but partly sideritic.
In upper 50 feet, intercalations of carbonaceous Siltstone, grey brown, clayey, abundant carbonaceous material, very fine sandy laminae.

(v) Otway group (Lower Cretaceous)

4798'-5220' Lithic Sandstone interbedded with minor Siltstone and Claystone.

Lithic Sandstone, dense, light grey, light green, medium to fine grained, fairly sorted, subangular, friable, zeolitic and calcitic cement, with some Chlorite, Zeolite, Chert, Glauconite, forming the lithic part. Partly broken up in loose grains, almost completely in lower 150 feet.

Siltstone, light green-grey, locally clayey, micaceous, with carbonaceous material. More abundant in upper 100 feet.

Claystone to Shale, light green, light grey, locally silty and Claystone, light grey to brown to black, slightly to very carbonaceous, partly sideritic, brown.

5220'-6075' Shale, more abundant in 5750'-5900' interval interbedded with minor lithic Sandstone and Siltstone, some Coal seams.

Shale, light green, locally silty, or light brown - light grey, with carbonaceous material, Mica, locally silty, or dark brown, carbonaceous, silty.

Lithic Sandstone (sub-feldspathic to feldspathic between 5650' and 5750'), dense, light grey, light green, fine to very fine grained, fairly sorted, subangular, friable, same lithic part as above, with carbonaceous material, some Feldspar, zeolitic cement and locally light brown calcitic cement below 5400'.

Siltstone, light green or grey, grey brown, with scarce to abundant carbonaceous material, and Mica, Feldspar, Chlorite.
Some thin seams of Coal, as above.

6075'-6700' (T.D.) Lithic Sandstone, with intercalations of minor Shale and accessory thin streaks of Siltstone. Two beds (about 5' thick) of Chert, at 6283' and 6345'.

Lithic Sandstone, as interval 5220'-6075' and below 6400', locally dark green, chloritic, occasionally red with lithic (volcanic?) particles, abundant calcite veins in lower 50 feet.

Shale, occasional thin streaks of Siltstone, few thin seams of Coal, as interval 5220'-6075'.

Chert, beige, very hard, with patches of white-light brown soft Calcite and locally of white clay, (altered Tuff?).

5. Structure

The structure tested by Nerita -1 is an elongate NE-SW trending anticline located approximately 15 miles offshore in the Torquay Sub-basin. It is the southern-most of two pronounced anticlinal structures, both situated along a mid-basin ridge, which appears to be an extension of the Bellarine High (Encl.1).

On seismic records closure occurs at all seismic horizons distinguishable over the structure and a sparker survey confirmed that the anticlinal structure is still present in the Lower Miocene strata outcropping at the seabed. A slight angular unconformity at the level of the seismic "B" Horizon indicates the presence of an initial structural development prior to the main deformative phase which was post-Lower Miocene.

The well was located on a culmination of the seismic "A", "B" and "Phantom T" horizons (Ref.No.3). The "A" Horizon originates from within the Torquay group, the "B" Horizon from the base of the Boonah formation and "Phantom T" Horizon, the deepest seismic event, from a level approximately in the middle of the Eastern View Coal Measures. Above the unconformity at the "B" Horizon the structure occupies an area within the lowest closed contour of 12 to 17.5 square miles with a vertical closure of 300 to 350 ft. Below the unconformity, at the level of "Phantom T" Horizon the structure occupies an area of 10.5 square miles with a vertical closure of approx. 450 ft.

The results from Nerita -1 are in good agreement with the structural picture obtained from the seismic surveys. An angular unconformity on the seismic records at the level of the "B" Horizon was confirmed by a break in the palynological sequence. Low dip readings from a dipmeter survey show that the well was drilled on the culmination of the structure.

6. Relevance to Occurrence of Petroleum

No hydrocarbon indications were noted from cuttings or sidewall cores, but minor shows of methane and traces of ethane and propane were recorded on the mud-return gas detector in the Eastern View Coal Measures, from 2850 feet downward and in the Otway group.

Petrophysical evaluation of the section drilled in Nerita -1 (Appendix II) shows all sands to be 100% water saturated. The formation water is characterised by a gradual and continuous downward increase in salinity from ca 2000 ppm to a maximum of ca 25000 ppm NaCl at T.D., 6700 feet.

Sand(stones) of the Boonah formation and the Eastern View Coal Measures show locally fair porosities. Three Schlumberger F.I.T.'s taken in this section at 2404, 3670 and 4777 feet recovered only fresh to brackish water. Sandstones in the Otway group are too tight throughout to be regarded as potential reservoirs and did not warrant testing.

Nerita No.1 was drilled on a location which offered possibilities for the accumulation of hydrocarbons, both from a lithological and structural point of view. While a considerable thickness of strata of reservoir potential was penetrated in the well, the prognosticated prospective interval was found to be almost entirely of continental facies remote from possible areas of hydrocarbon generation.

7. Porosity and Permeability of Sediments Penetrated

No cores were cut in Nerita -1 and, consequently, no direct measurements are available on porosity and permeability of the sediments.

Calculated values of porosities were obtained from the Formation Density log. For sands and sandstones of the Boonah formation and Eastern View Coal Measures porosity values range from 21-31% and for the sandstones of the Otway group values from ?25% to less than 10% were determined (see Appendix II).

Porosities as described from sidewall cores (Appendix IV) give generally lower values, partly due to "impact compaction" of the sample, but also due to the presence of much clayey matrix in the unconsolidated sands, which undoubtedly accounts for part of the porosity value indicated in the FDC log.

No porosities of the unconsolidated sand intervals could be established from the cuttings, as the clay matrix was washed out in the mud flow, leaving a sample of clean quartz grains behind on the shale shaker.

8. Contributions to Geological Concepts Resulting from Drilling

Prior to the drilling of Nerita -1 well it was known from surface and subsurface geological studies by various authors that in its post-Lower Cretaceous development the Torquay Sub-basin differed in many respects from the remainder of the Otway Basin.

The marine seismic surveys undertaken by Shell Development and the drilling of Nerita -1 have confirmed the validity of this concept and at the same time have provided much new information leading to a better understanding of the geological history of the Torquay Sub-basin:

(1) The 1,902 feet of Otway group sediments penetrated showed similar characteristics to the sediments of this group elsewhere, thus confirming once more the uniformity of sedimentary development in the Otway Basin during the Lower Cretaceous. In Nerita -1, as elsewhere, sandstones of the Otway group were found to be too tight to have any reservoir possibilities. The locally abundant occurrence of zeolites provides additional evidence for regional zeolitisation of the Otway group (Appendix IV and Ref. No.4, p.20).

(2) The Upper Aptian-Upper Albian Coptospora paradoxa Zone found in the upper 2000 feet of the Otway group in Pecten -1A in the Port Campbell Embayment is missing in Nerita -1, indicating comparatively deeper erosion of the Otway group at the Nerita location (Appendix VI, Ref.4, Appendix X).

(3) The presence of Upper Cretaceous sediments in the offshore part of the Torquay sub-basin, a possibility which was suggested previously in several studies, could definitely be established. The lower 650 feet (approx.) of the Eastern View Coal Measures are of Upper Cretaceous age and are overlain by a section approx. 350 feet thick which has to be considered as an Upper Cretaceous - Paleocene transition zone.

(4) An angular unconformity was found at the top of the Eastern View Coal Measures, separating this formation from an overlying sequence of similar lithology, the Boonah formation. Previously known only from limited surface outcrops, the Boonah formation shows much more variety in lithology than originally described making the proposed name of Boonah formation more appropriate than the original Boonah Sandstone.

(5) The post-Otway group rock units in Nerita -1 are readily correlated with the stratigraphic units established previously in the onshore part of the sub-basin and are equally different from the remainder of the Otway Basin. A main difference is the absence of transgressive-regressive cycles in the Upper Cretaceous and Lower Tertiary as are found in the Port Campbell Embayment. In fact, the continental Eastern View Coal Measures and Boonah formation seem to have more resemblance to the Latrobe Deltaic Complex in the Gippsland Basin.

(6) The Nerita structure shows closure at all seismic horizons and the anticlinal structure is still present in the Lower Miocene strata outcropping on the sea floor. The slight angular unconformity at the top of the Eastern View Coal Measures indicates the presence of an initial development of the structure prior to the main post-Lower Miocene deformation. In its late Tertiary deformation the Torquay Sub-basin shows more resemblance to the Gippsland Basin than to the remainder of the Otway Basin.

In conclusion it appears that the Torquay Sub-basin both from a stratigraphical and a structural point of view differs considerably from the rest of the Otway Basin in its post-Lower Cretaceous development and seems to have more affinity to the Gippsland Basin.

V. REFERENCES

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LIST OF SCHLUMBERGER LOGS

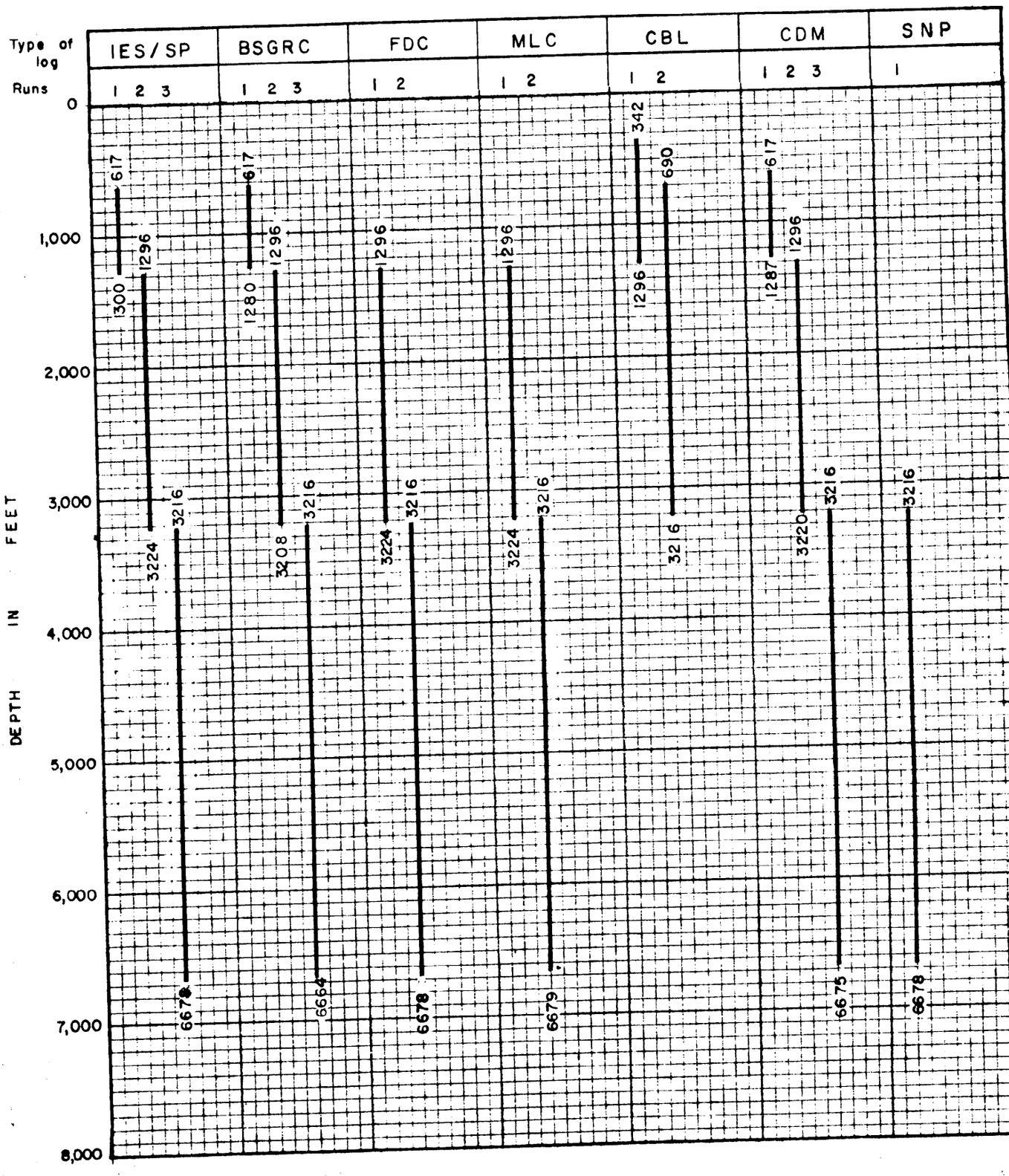
RUN IN NERITA 1

LOG	RUN NO.	DATE - 1967	INTERVAL LOGGED	SCALE (ins/100ft)
IES/SP	1	10th July	1300 - 617	1.5
	2	17th July	3224 - 1296	1.5
	3	30th July	6679 - 3218	1.5
BSGRC	1	10th July	1280 - 617	1.5
	2	17th July	3208 - 1296	1.5
	3	30th July	6664 - 3218	1.5
FDC	1	18th July	3224 - 1296	1.5
	2	31st July	6678 - 3216	1.5
MLC	1	18th July	3224 - 1296	1.5
	2	31st July	6679 - 3216	1.5
CBL	1	18th July	1296 - 342	-.5
	2	31st July	3216 - 690	1.5
CDM	1	10th July	1287 - 617	2.5
	2	18th July	3220 - 1296	2.5
	3	31st July	6675 - 3220	2.5
SNP	1	31st July	6678 - 3216	1.5
Formation Tester	1	31st July	3670,4777,2404	-.5

NERITA - 1

SUMMARY OF SCHLUMBERGER LOGS

Note : All logs have been run on two scales 1. 1" = 100' (1/1200) 2. 5" = 100' (1/240)



Appendix I A

Drawing No 2090

SIDEWALL CORE DESCRIPTIONS - NERITA -1

672' Siltstone: brownish grey, composed of angular quartz, sorted, in moderately abundant grey clay and calcareous matrix. Slightly micaceous, with isolated very small ferruginous patches and thin bands and lenses of cleaner, white and yellow quartz silt. A moderately rich foraminiferal fauna is present.

692' Clay: grey, soft, dense, homogeneous, very poorly bedded, very slightly calcareous, with clay pellets and almost no visible detrital grains. Small irregular patches of pyrite are widespread.

764' Siltstone: buff, locally greenish grey to brownish. Composed of fine grained quartz, clear to yellow and ferruginous, angular, very well sorted; plus rare lithic grains; with sparse small glauconite pellets, carbonaceous specks; set in a minor calcareous matrix. Poorly bedded, varies from clean porous siltstone, to slightly darker calcite-cemented siltstone. Calcareous benthonic foram fauna visible.

808' Marl: grey-brown, bedded, slightly pyritic, dense, homogeneous, with a very high percentage of calcareous foraminifera along the bedding planes.

889' Sandy lime grainstone: porous, composed of 75% medium grained calcareous particles - bryozoal fragments, foraminifera, and unidentifiable fragments; and 25% clear angular quartz; rare pellets of dark green to light green glauconite occur. The rock is friable, and well sorted, with almost no matrix. An abundant shallow water foraminiferal fauna is present.

Thin section: Sandy lime grainstone very porous, well sorted, almost no matrix. Composed of about 75% carbonate grains; 25% clastics. Carbonate grains: bryozoal echinoid and shell fragments, rare sponges, algae and foraminifera. Some foraminifera are partly filled with glauconite. The average grain size of carbonate particles is 0.3 to 0.6mm. Rare bright green glauconite pellets occur.

Clastic grains are angular to subrounded, 0.1 to 0.6mm in diameter, and consist of quartz, orthoclase, rare chert and quartzite. Occasionally the clastic grains are concentrated along poorly defined bedding planes; elsewhere they are randomly distributed.

940' Quartz sandstone: slightly porous, grey-green, medium to coarse grained, sorted, slightly friable, calcareous. Composed of about 60% subangular to subrounded quartz and rare lithic grains, with small amounts of shell fragments, foraminifera, other calcareous grains and glauconite pellets, set in a matrix of approximately 10% patchy glauconitic clay and/or reddish brown crystalline dolomitic cement.

Thin section: Moderately sorted, medium to coarse grained, composed of about 60% clastic material; 30% carbonate debris; 10% glauconitic matrix. Clastics include subangular to rounded grains of quartz, strained and unstrained, with minor amounts potash felspar, plagioclase, perthite, gneiss, chert, granitic fragments,

and very rare muscovite. The latter types comprise 10% or less of the total clastics. Heavy minerals include blue and brown tourmaline, pale pink garnet, epidote and very rare zircon.

The carbonate debris comprises shallow water benthonic foraminifera; calcareous algae (well rounded), bryozoal and shell fragments. Most of the organic matter is abraded and broken, suggesting high energy environment of deposition.

The matrix is greenish brown clay, probably derived from the breakdown and alteration of glauconite pellets forming a sporadic coating between grains and mixed with a little carbonate mud. The glauconite grains show various stages of breakdown towards such a matrix.

946' Quartz Sandstone: calcareous, similar to 940', but finer grained, well sorted and friable. Composed of 65% fine grained angular quartz, 30% bryozoal and shell fragments and foraminifera, and 5% matrix of clay and carbonate. Sparse very small glauconite pellets. Contains a rich shallow water foraminiferal fauna - mainly Cibicides.

981' Quartz Sandstone: dense, brown, medium - fine grained, well sorted, angular to rounded clear angular to frosted rounded grains, (lithic), (micaceous), contains greenish - fawn to grey-green glauconite pellets, shell fragments, and other skeletal material, chalky white and possibly partly recrystallized, including some bryozoal fragments. Abundant brown finely crystalline dolomite or siderite tightly cements the rock. Rare small patches of pyrite are also present.

1035' Clayey Siltstone: dark grey; sorted quartz silt, angular, (lithic), with a clay matrix, varying from 25% to 5% in different parts of the core. Micaceous in places; also containing patchy thin shell debris and foraminifera - often associated with finely crystalline pyrite patches.

1090' Silty shale: dark brown, clayey, dense, massive, homogeneous, very pyritic; abundant calcareous fauna present.

1130' Silty shale: dark brown, well bedded, very clayey, with rare bands of quartz silt; micaceous, very pyritic; small calcareous fauna present.

1197' Quartz sandstone: slightly porous, yellow-buff, medium to very coarse grained, well sorted angular to subrounded, about 5% bright green glauconite pellets; very rare shell fragments; set in a sucrose finely crystalline cement of orange (?) dolomite comprising about 35% of the rock. Friable.

Thin section: As above. Recrystallized shallow water benthonic foraminifera are present in the carbonate cement. Very rare lithic grains include chert, gneiss, felspar, and tourmaline.

Sucrosic (?) dolomite has cemented but only rarely replaced grains. (see Plate 1).

1219' Siltstone: dark brown, carbonaceous, sandy; patchy distribution of fine to coarse grained sand in a dark brown clay matrix. The sand ranges from 1mm to less than 0.1mm in diameter, and is angular to rounded. Pyritic patches are common, glauconite rare. Sparse distribution of calcareous grains and foraminifera throughout.

1255' Quartz sandstone: dense, light brown, very hard; fine grained, angular, well sorted, (lithic), (glauconitic), contains foraminifera, set in 30% cement of crystalline light brown carbonate. The core is brittle and shattered.

Thin section: Angular grains of quartz (90%), chert(3%), felspar(1%), glauconite(1%), foraminifera(1%) and unidentifiable material (4%) are set in a sucrose cement of buff to pale brown dolomite. Most grains are rimmed with a thin dark coating of ?dolomite and surrounded and part replaced by sucrosic dolomite. The central portions of a few interstices are filled by clear calcite. Dolomite replacement has been most extensive in lithic and felspar grains; some grains are now unidentifiable.

1268' Quartz sandstone: slightly porous (est. 3%), grey-buff, medium-very coarse grained, poorly sorted, "dirty", rounded, in a matrix of fine grained angular quartz grains 0.2 mm across; rare small grains of glauconite are also present. A minor amount of grey-brown carbonate cement has a rather patchy distribution.

1280' Siltstone: dark to medium brown, composed of varying amounts of fine grained quartz silt and dark brown carbonaceous clay. The rock is bedded, poorly sorted, shell fragments are visible.

1290' Siltstone: dark brown; composed of 70-75% fine grained quartz silt, rare mica and calcareous grains set in 25-30% matrix of dark brown clay. Poorly bedded.

1382' Siltstone: dark brown, moderately to well sorted, very fine grained, quartzose, ferruginous; minor lithic grains; slightly micaceous; subordinate clay matrix, slightly ferruginous, carbonaceous. Pyritic patches common, mainly filling worm burrows. Bedding irregular, lensoidal; alternating dark clay-rich and ferruginous sandy streaks; disruption of sediment by burrowing organisms evident.

1545' similar to 1382'. Siltstone: dark brown, very fine grained; alternating laminae and lenses of slightly ferruginous quartz silt, and dark brown clayey quartz silt. Bright green glauconite pellets scattered throughout. Tiny patches clear quartz sand, uncemented. Bedding disrupted by abundant pyrite-filled worm burrows.

2035' similar to 1382', 1545'. Siltstone: dark brown, very fine grained, sorted, angular, slightly ferruginous quartz, clean, little matrix, alternating with dark brown clayey carbonaceous laminae with minor quartz and calcareous bioclastic fragments. Sparse glauconite pellets scattered throughout. Slightly micaceous, pyritic. Blurred laminae disrupted by worm burrowing; pyrite filled burrows.

2106' Siltstone: medium grained, brown to dark brown. Rounded to subangular clear quartz set in matrix of dark brown clay. Rare mica, glauconite pellets. Very poorly defined bedding 1 - 2 cm thick; consists of alternation of clean sorted quartz, with very little matrix and localized porosity up to 10%; and dark clay-rich bands (over 50% clay) containing glauconite, rare worm burrows, pyrite filled.

2156' Laminated siltstone and quartz sand: Alternating (a) clean white quartz sand, very fine grained, well sorted, angular, slightly porous, showing minor cross-bedding on microscopic scale; in bands 1 - 2 cm thick; and (b) dark carbonaceous shaly siltstone, micaceous with carbonaceous flecks, and minor ferruginous quartz; in bands 2 - 3 mm thick. Laminae vary from sharply defined horizontal layers to irregular lensoid bodies.

2208' Quartz sand: very porous (est. 20% +) fine to medium grained, clear, subangular, very well sorted. Abundant glauconite pellets, light to dark green. Rare lithic grains. Rock semi-consolidated, no cement, no matrix, permeable.

Thin section: very well sorted angular to subangular grains; bedded; no matrix; porous. Contains an estimated 85% quartz, 12% lithics and mica, 3% glauconite. The lithics include chert, quartzite, fine grained metasediments, rare altered (?) volcanics. The mica is mainly muscovite, with some biotite.

The rock is fairly fresh and there is only minor alteration of the glauconite and micas.

2270' Alternating fine quartz sand and shale: Sand 25%, Shale 75%

2 cm thick	(Brown, slightly carbonaceous shale bands, (2 - 6 mm thick, horizontally bedded, (separated by very thin (0.1-0.2 mm) streaks (clean white very fine sand
0.6 cm thick	(Band of clear quartz sand, locally porous ((7-10%) fine grained, very well sorted, (angular; cemented in patches with abundant (finely crystalline pyrite.

2295' Coal: black, dull to moderately lustrous, bedded, with finely crystalline pyrite along regular bedding planes, conchoidal fracture.

2327' Quartz sand: dense, unconsolidated medium-coarse grained quartz, rare lithic grains, angular to subangular, moderately sorted. Set in abundant matrix of buff to white, silty clay.

Thin section: Approximately 80% angular, poorly sorted clastic grains in 15% - 20% matrix and secondary cement. Clastics are mainly coarse grained quartz, with minor potash felspar (orthoclase and microcline) quartzitic, aplitic and granitic fragments, very rare altered volcanics and hornblende grains. Quartz grains often have strained extinction and are sometimes compound.

The matrix (5%) is composed of angular fine grained fragments of the same composition as the larger grains.

The cement is a crystalline pale buff clay mineral, with tabular habit, occurring as bands of parallel crystals; as radiating aggregates of thin crystals, showing first-order grey interference colours; or as fine-grained matted masses with higher interference colours. The mineral resembles pyrophyllite in form and birefringence. It has probably formed from the breakdown of felspars, and is widely distributed through the rock.

2496' Silty mudstone: grading to shaly silt. Medium grey, slightly bedded, with thin streaks of carbonaceous material along bedding planes. Dense, massive, non-fissile.

2533' Quartz sand: dense, unconsolidated, grey-white, fine to pebbly, poorly sorted, angular to subangular quartz, abundant matrix of white clay and silt.

Thin section: Many of the pebbles are compound grains of quartz, strained and fractured, occasionally broken during deposition, and with clay and silt penetrating along broken cracks. The matrix is composed of silt-sized quartz, muscovite and recrystallized clay - some of it similar to the clay at 2327'.

2570' Shale: slightly silty, grey-brown, dense, massive, faint traces of bedding, hair-thin carbonaceous streaks, irregular small lenses of coaly material.

2614' Siltstone: light grey, very fine grained, very well sorted angular quartz, clean, no matrix, with abundant very fine carbonaceous streaks, discontinuous.

2682' Carbonaceous shale: dark grey to black, micaceous, slightly pyritic, with irregular, streaks of coal up to 2 mm thick.

2712' Quartz sand: dense, buff to white, unconsolidated, very coarse to very fine grained, pebbly subrounded to subangular, mainly clear but with some milky granitic pebbles up to 6 mm across, very poorly sorted - quartz grades down into silt-size. Small amount grey-white matrix.

Thin section: Pebbles are composed of strained quartz, compound grains of interlocking quartz, foliated quartz, coal fragments and carbonaceous siltstone.

The matrix is quartz silt with a little clay.

2816' Quartz sand: slightly porous, semi-consolidated to unconsolidated, light grey, medium grained, subangular to subrounded, moderately well sorted except for rare pebbles. Small amount white silty clay matrix.

Thin section: Quartz grains are fractured and strained; often compound, with a granular texture, sometimes foliated. Potash felspar grains, chert, quartzite, muscovite and very rare bleached biotite form a small percentage of the rock. The matrix is of fine silt locally grading to clay. Rare small patches of bright green clay, probably glauconite, occur between grains.

2846'	Shale: medium grey, slightly silty, micaceous, blobs of carbonaceous material, massive, bedding very poorly defined.
2884'	Siltstone/silty shale alternation (a) White very fine grained siltstone, of angular very well sorted quartz, porous, no matrix. (b) Grey silty shale, slightly carbonaceous. Arranged in bands, 1 - 2 mm thick. Ripple - marking, minor scouring, sand lensing visible. Truncation of small-scale cross-bedding in white siltstone by shale band.
2931'	Sublithic sandstone: slightly porous, light grey, medium-coarse grained, moderately well sorted quartz with lithic grains, and moderately abundant fragments of biotite and carbonaceous material. Friable, no matrix. Thin section: A biotite-rich lithic to sublithic sandstone composed of moderately sorted angular quartz, potash felspar, plagioclase, chert, siltstone, fine grained metasediments, carbonaceous streaks, muscovite, and abundant grey-brown bleached biotite. Grains are fairly closely packed and grain boundaries blurred by alteration of the lithics to clay. Matrix, if present, is indistinguishable due to this effect.
2954'	Silty shale: grey-brown, micaceous, massive; with scattered carbonaceous fragments 2 - 3 mm long.
2964'	Quartz sand: slightly porous, light grey, semi-consolidated, fine grained, angular to subangular, well sorted; set in a very small amount of white clay matrix. Thin section: as above. About 7% of the rock is made up of chert, felspar, muscovite, biotite, metasediment and rare carbonaceous grains.
2989'	Siltstone: white, very fine grained quartz, very well sorted, angular to subangular, with minute grains carbonaceous material. No matrix, porous. Faintly bedded - slight variations in quartz colour.
3001'	Siltstone: grey, flecked. Very fine grained, very well sorted quartz, with subordinate carbonaceous grains. Flecking is due to distribution of carbonaceous grains and carbonaceous coating around quartz.
3048'	Silty shale: grey-brown, slightly carbonaceous, micaceous, massive.
3084'	Shale: dark brown-grey, micaceous, with white streaks of fine grained sand.
3107'	Shale: grey-brown, slightly carbonaceous, slightly micaceous.
3149'	Shale: grey-brown, slightly silty, micaceous.

3155'	Quartz sandstone: porous, white, fine grained, angular, very well sorted, rare lithic grains, moderately abundant white mica; rare biotite-rich laminae. Clean no matrix. Thin section: contains about 15% to 20% muscovite, microcline, metasediments, chert, and minor biotite. The biotite is concentrated in thin regular laminae having a higher proportion of carbonaceous material, lithics and felspar than average. There is no matrix; alteration of some lithics produces a little sericitic clay around a few grains.
3215'	Banded siltstone: fine grained white quartz sand; clean, angular, very well sorted, porous; alternating with carbonaceous siltstone. Bands are 5-6 mm wide. Moderate porosity limited to sandy layers.
3230'	Quartz sandstone: dense, white, very fine grained, angular, well sorted; very rare lithic and carbonaceous fragments; set in abundant white carbonate cement (probably calcite). Sandstone is very hard. Core is shattered and deformed.
3253'	Shaly siltstone: grey-brown, prominently banded, with subordinate thin streaks and bands clean white siltstone up to 2mm thick; the bulk of the rock is very fine grained grey quartz, angular, well sorted, micaceous, with probably some clay present.
3333'	Banded shaly siltstone: similar to 3253'. Irregular bands of greyish-brown shaly siltstone - of very fine grained quartz, mica, minor carbonaceous material - up to 3mm thick (60%); with very fine grained white quartz siltstone, clean, very well sorted, in bands 0.5-1mm thick (40%). Banding very fine, slightly wavey, lensoid.
3434'	Banded shale/siltstone: identical to 3333' above, excep for slightly greater difference in grain size - grey shale is slightly finer; white silt slightly coarser than above.
3468'	Quartz sand: porous, whitish to pale grey, very fine tc medium grained, sorted, angular clear quartz and grey, black and white angular lithic grains. Clean, no matri: no cement. Thin section: shows a minor amount of orthoclase, perthite, chert, quartzite, fine-grained metasediments, and heavily altered ?volcanic grains in addition to the quartz.
3531'	Siltstone: grey-brown, fine grained; similar to the banded siltstones described above (3253', 3333' etc.).
3570'	Quartz sandstone: porous, white, medium-coarse graine poorly to well sorted, angular and subangular quartz plus rare lithic grains and mica (5%). Clean, loosely consolidated, no matrix or cement. Cut by band of fragmentary coal, 1-2mm thick; with very minor clay. Thin section: Bands of dark brown carbonaceous material contain clay. The composition of the grains similar to the sands described above - granitic fragm compound quartz grains, strained and unstrained quartz aplitic grains, altered biotite, and very rare altere volcanics.

3587' Shale: silty, grey-brown, very fine grained quartz, slightly micaceous, slightly carbonaceous. Very rare white quartz siltstone lenses as in 3253' etc.

Siltstones and sands down to this depth (3230-3587') are all fairly similar. Below this, there is much more variation in sediment type.

3666' Quartz sandstone: slightly porous, pale grey-buff, medium to coarse, moderately sorted angular quartz with minor angular lithic grains. Small amount silty clay matrix. Sand is massive, no bedding or other internal structure.

Thin section: Shows about 15% weathered orthoclase, rare plagioclase, altered biotite, quartzitic and siltstone fragments.

3700' Coal: finely and irregularly bedded, with alternating bands earthy dull brown durain and black vitrainite. One small pocket containing white crystalline minerals - possibly secondary quartz? and kaolinite.

3704' Shale: dark brown, very fine grained, carbonaceous, with a thin band of coal 0.5mm thick. Finely laminated lensoid bedding, possibly deformed - slickensiding on many surfaces.

3758' Quartz sandstone: slightly porous to dense, white, medium to coarse grained (0.3-3mm) poorly sorted, angular to subangular clear quartz, felspar, rare mica, very rare lithic grains. Contains very thin (0.5mm) fragmentary coal lens. The sandstone is massive, moderately consolidated and has a matrix of 5% white silty clay.

Thin section: Contains about 15% - 20% weathered, fractured orthoclase, and bleached biotite. The biotite occurs as highly deformed flakes filling some interstices. The silty matrix grades into crystalline clay formed from the alteration of the felspar.

3768' Quartz sandstone: clayey, dense, white, medium to fine grained, poorly sorted, angular, with very rare lithic grains, semiconsolidated. The quartz grades down into abundant silt-sized matrix with white clay.

3830' Quartz sandstone: dense, grey-buff, medium to very coarse grained (0.5-2.0mm); well sorted, angular, very rare lithic grains, rare white mica, with matrix of approximately 5% silty white clay, massive, fairly well consolidated.

Thin section: Contains quartz, orthoclase, rare bleached biotite, quartzite, siltstone, vein quartz, grains of compound quartz, and a trace of tourmaline gneiss. Some intergranular porosity is present, but most of the intergrain space is filled with silty clay. There is a little cementation and replacement by coarsely crystalline calcite.

3867' Shaly siltstone: light grey, poorly banded. Mainly white very fine grained quartz siltstone with some clay; interbedded with grey, slightly carbonaceous silty shale. Banding probably lensoid.

3880' Quartz sandstone: dense, greyish white, fine to very fine grained, subangular quartz, sorted, grading down into silt-sized grains with a little clay. Grading to -

Silty sandstone: finer grained than above, white, with greater amount silty matrix. Rock moderately well consolidated.

Thin section: Contains the same type of clastic material as the higher sands, e.g. 3830' - minor orthoclase, chert, interlocking quartz (possibly vein type) etc.

3908' Coal: black, splintery, fragmentary, bedded, dull to subvitreous.

3978' Silty clay: light grey, very fine grained quartz in clay matrix. Dense, homogeneous, structureless except for rare carbonized plant fragments.

3986' Carbonaceous shale: grading to low rank coal. Black, platy, thin bedded. Dull sheen on some laminae.

4015' Quartz sandstone: dense, grey to buff, fine to coarse grained, very poorly sorted; 70% angular quartz set in 30% matrix of silty buff to fawn clay. Complete gradation from coarse to finest quartz in matrix. Massive, consolidated.

4065' Shaly siltstone: dark grey, fine grained, carbonaceous, slightly micaceous; with large angular grains of quartz (up to 3mm) and weathered felspar scattered sparsely throughout. Dense, fairly homogeneous, bedding very faintly defined.

4191' Siltstone: dark grey to light brown, moderately sorted, bedded, laminated fine grained quartz (0.1-0.2mm), very abundant white mica and carbonaceous material form poorly defined layers 2cm and more thick. Thin coal laminae of less than 1mm also present.

4245' Shale: dark grey, slightly silty, slightly micaceous, rare thin coal laminae, scattered larger grains angular quartz up to 2mm as in 4065'.

4372' Shale: light grey, clayey, massive, homogeneous. Very rare flecks brown organic material.

4460' Quartz-feldspathic sandstone: slightly porous, white, medium-very fine grained, poorly sorted, angular quartz grading down into fine silt size. Massive. Thin fragmentary coal band crosses core.

Thin section: Poorly sorted grains of abundant weathered orthoclase and quartz, minor bleached biotite deformed between grains; rare siltstone grains, fine-grained metasediments, carbonaceous material and volcanic glass(?).

Matrix is minor and consists of silt grading into clay. There is minor calcite replacement of some grains.

4534' Shale: medium grey, with fine grained mica, rare carbonaceous flecks. Homogeneous, slightly platy fracture in places.

4628' Shale: medium grey, very similar to 4534', micaceous, more carbonaceous.

4660' Shale: medium grey, micaceous, carbonaceous; with thin, poorly defined bands very fine grained white quartz silt. Dense, fairly massive.

4776' Sandstone: porous, light grey medium to very coarse grained (0.5-1.8mm) angular to subrounded quartz, plus lithic grains, well sorted, with small amount (3%) silty clay matrix.

Thin section: Shows about 30% lithic and felspathic grains, including aplitic grains, chert, micaceous siltstone, orthoclase, rare microcline, and unidentifiable grains. There are sparse grains of glauconite and small patches of glauconitic clay.

4782' Quartz sandstone/shale: moderately sorted quartz sandstone, fine-coarse grained (0.2-1mm) angular, subordinate lithics, plus very rare glauconite pellets in abundant white clay matrix; alternating in irregular lensoid bands with: dark grey shale, carbonaceous, with thin disrupted coal laminae; lensing, truncation of bands, small scale scour and fill structures suggest rippled sediments in tidal flat environment.

4804' Shale: green grey, dense, homogeneous; contains very fine grained quartz silt, rare mica (biotite and white mica), rare carbonaceous flecks, abundant chloritic clay.

4944' Shale: medium grey, dense, massive, trace carbonaceous material.

5068' Lithic sandstone: dense, grey-green, fine-medium grained (0.2-0.5mm) angular to subrounded, well sorted grey, green and black lithic grains (60%), plus mica and 35% quartz and felspar; set in small amount green chloritic and white crystalline (probably zeolite) cement. Small patches coaly material. No bedding.

Thin section: Lithic sandstone - composed largely of shale fragments; with lesser quartz, quartzite, chert, glassy volcanic fragments, rare oligoclase and biotite (fresh and bleached). There is less than 10% quartz in the rock. Almost no matrix is present; there is a trace of crystalline clay between some grains.

5226' Shale, dark grey, homogeneous, fissile.

5287' Shale: structureless, homogeneous as above.

5327' Shale/sandstone (60%/40%): grey-green very fine chloritic shale with a band of lithic sandstone 6mm thick. The fine grained sandstone is dense and contains about 55% lithics, 30% quartz and felspar. 15% green chloritic and white zeolitic cement.

5475' Lithic sandstone: dense, grey-green, fine grained, sorted, 60% grey, green and black lithic grains, 30% grey and white quartz and felspar, and 10% chloritic clay matrix plus a little white crystalline (zeolitic?) cement.

Thin section: Angular grains of metasediments, altered (?)volcanics, abundant plagioclase (oligoclase and some andesine), occasionally with zoned crystals; potash felspar, chert, biotite, and relatively minor quartz present in section.

The matrix is of minor greenish chloritic clay. Calcite crystals are developed occasionally as cement; also rarely replace grains.

5522' Sublithic sandstone: dense, grey, fine grained, moderately sorted; 60% fine grained angular quartz grading to silt size; 35% lithic grains; and small amount white crystalline cement.

5561' Shale: light grey, slightly silty, unbedded, homogeneous.

5612' Siltstone/shale: minor bands of grey-green shale in a grey clayey siltstone, lithic to sublithic, carbonaceous, micaceous, with a thin coal band, 0.5mm thick. Poorly defined irregular bedding. No porosity.

5700' Lithic sandstone: dense, grey-green, medium grained, well sorted, massive, composed of angular to subrounded lithic grains, green, grey and black; quartz and felspar (grey-white and pinkish), with scattered carbonaceous material. Very small amount white crystalline cement.

5900' Shale: dark grey, slightly micaceous, homogeneous; with rare carbonized plant impressions, grey.

5928' Shale: a few slightly silty patches; tiny flecks black carbonaceous material throughout.

5982' Shale: grey, fairly homogeneous, very finely disseminated carbonaceous material darkens the colour in places.

6068' Shale: medium-dark grey, almost entirely clay; slightly slickensided, fractured.

6285' Shale: light grey, irregularly bedded, slightly indurated, heterogeneous; composed of irregular beds of shale and grey silty shale, with thin seams and patches of soft white clay -? bentonitic. Irregular fracture.

Thin section: Brecciated shale composed of large and small fragments of angular shale of varying size set randomly in a fractured zone filled with finely crystalline colourless clay, and with a little finely crystalline secondary carbonate.

6350' Lithic sandstone: dense, green, fine-medium grained, subangular to subrounded, moderately sorted grains lithics, quartz and felspar, in a silty clay matrix. probably rich in chlorite.

Thin section: Lithic sandstone - containing angular grains of shale, plagioclase, potash felspar, quartz, siltstone, altered (?)volcanics, and biotite, set in an abundant green chloritic matrix. Bedding is absent. Sorting is variable - poorly sorted silt-sized material is present in parts of the thin-section.

6394' Shaly siltstone: grey, grades into silty shale: grey, lithic to sublithic, poorly sorted, angular grains with much clay. Rare coal fragments up to 2mm long. Bedding almost absent.

6456' Silty shale: grey, poorly defined banding of slightly lithic silty, and clay-rich carbonaceous shales.

6544' Lithic sandstone: dense, green, medium grained, sorted, subangular, lithic and quartz grains set in small amount silty and dark green chloritic clay matrix.

Thin section: Composed of metasediments, felspar (plagioclase; minor potash felspar), quartz, chert, siltstone, trachytic grains, andesitic, and carbonaceous grains; with traces of diopside, epidote, and biotite.

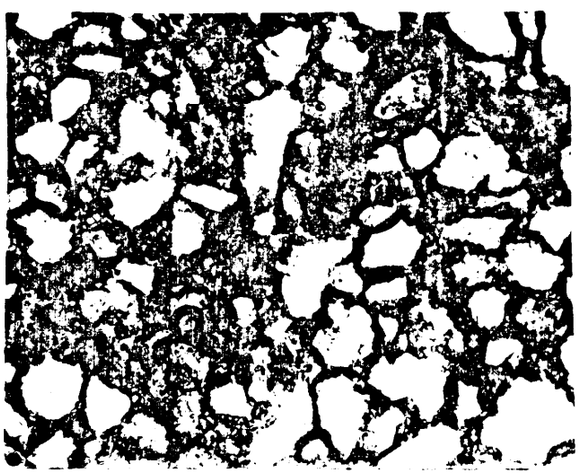
The matrix is largely chloritic; but in places lacking chlorite, the zeolite laumontite occurs as a crystalline cement, to a small degree replaces rock fragments.

6645' Lithic sandstone: dense, grey-green, medium to fine grained, well sorted tightly packed subangular quartz, felspar and lithic grains. Very little matrix. Core is partly shattered, broken to sand.

Thin section: The lithic grains include fine grained metasediments, altered and fresh volcanics, and chert; rare biotite; abundant plagioclase, both altered and fresh; and angular quartz.

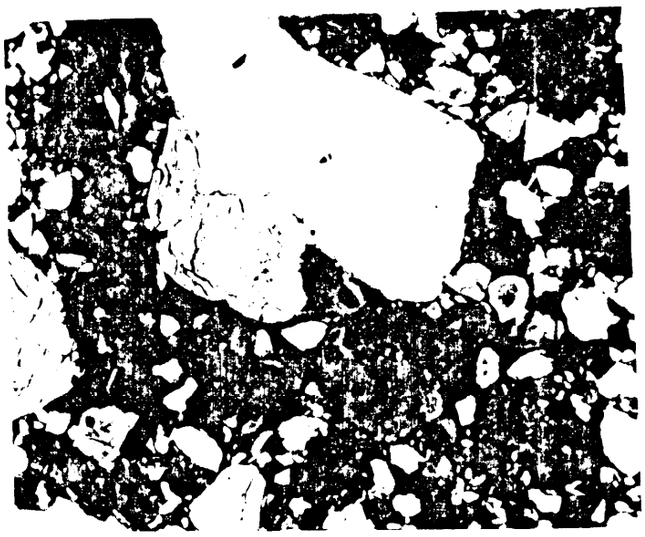
Greenish-brown chlorite formed during early diagenesis rims many grains. Other intergranular areas are cemented with abundant crystalline zeolite (laumontite), which also replaces many felspar grains. The laumontite occurs as clear crystalline patches with a flaky appearance due to the undulatory extinction and poorly defined boundaries between adjacent crystals. The laumontite comprises 5% to 10% of the rock.

Plate 1.



Thin section, sidewall core 1197' x50

Angular quartz grains in a sucrose cement of pale brown crystalline (?)dolomite.



Thin section, sidewall core 2533' x25

Crossed nicols.

Poorly sorted sandstone, showing granitic pebbles.

APPENDIX II

PETROPHYSICAL EVALUATION NERITA -1

by

Shell Development (Australia) Pty.Ltd.

R_w and S_w Estimate

DEPTH (ft bdf)	SP MV	E_c MV @77°F	R_w Ω m @77°F/@BHT	Ø % on FDC	"m"	F	R_o Ω m @ BHT	R_{IL} Ω m @ BHT	I	"n"	S_w %	REMARKS
2,406	-	-	2.8/1.9	25	1.8	12.1	23.0	23.0	1.0	1.6	100	) Rw estimated from
2,738	-	-	2.8/1.9	29	1.8	9.3	17.7	19.0	1.07	1.6	96	) Resistivity / Porosity
3,039	-	-	1.3/0.9	31	1.8	8.2	7.4	6.0	<1	1.6	100	) plot. SP not suitable for
												) Rw determination.
3,460	20	9	.86/.43	26	1.8	11.2	4.8	6.5	1.35	1.6	83	
3,830	30	18	.64/.36	27	1.8	10.5	3.8	3.0	<1	1.6	100	
4,015	40	26	.48/.25	21	1.8	16.5	4.1	2.2	<1	1.6	100	
4,260	52	35	.35/.18	24	1.8	13.0	2.3	1.6	<1	1.6	100	
4,776	55	38	.33/.17	24	1.8	13.0	2.2	2.0	<1	1.6	100	
5,434	-	-	.23/.12	18	2.0	30.8	3.7	6.5	1.75	1.6	70	) Rw estimated from
5,700	-	-	.23/.12	20	2.0	25.0	3.0	7.0	2.33	1.6	59	) Resistivity/Porosity plot
6,240	-	-	.23/.12	5(?)	2.0	400.0	48.0	17.0	<1	1.6	100	) since SP not suitable
6,500	-	-	.23/.12	5(?)	2.0	275.0	33.0	28.0	<1	1.6	100	) for Rw determination.

DEVIATION SURVEYS RECORD - NERITA -1

Depth (ft)	Deviation (o)
470	$\frac{3}{4}$
629	$\frac{3}{4}$
1260	$\frac{1}{2}$
1300	$\frac{3}{4}$
1700	$\frac{3}{4}$
2440	1
3030	$1\frac{1}{4}$
3216	$1\frac{1}{4}$
3390	2
3670	$1\frac{3}{4}$
3950	$\frac{3}{4}$
4420	2
4555	$2\frac{1}{2}$
4790	2
5110	$1\frac{1}{2}$
5840	$1\frac{1}{2}$
6100	2
6360	$2\frac{1}{2}$
6660	$1\frac{1}{4}$

PALAEONTOLOGICAL REPORT

NERITA -1 WELL

by

S.D.A. Geological Laboratory

CONTENTS

1. INTRODUCTION

Nerita -1 was drilled twelve miles offshore in the Torquay Sub-basin of the Otway Basin, at latitude 38° 37' 43.19"S and longitude 144°13'44.83"E.

No conventional cores were taken. Of a total of 97 sidewall cores received, 32 were examined for foraminifera, 25 were used for microfloral analysis and 26 cores were thin-sectioned.

Cutting samples were also used for foraminiferal analysis in critical intervals and where sidewall cores were widely spaced, or unsuitable for analysis. Samples were examined from 672' to the top of the Otway group at 1798'. No *in situ* foraminifera were found below 2000'; the 33 sidewall core and cutting samples examined below this depth have not been documented in this report. The positions of samples which yielded *in situ* foraminifera are given in enclosure 1, with a quantitative tabulation of the main species found. A condensed range chart of stratigraphically important species is given in text-figure 1.

All depths given are below drilling floor (B.D.F.) which was 112' above mean sea level. The sea bed was 357' B.D.F.

With the exception of the top of the Eocene, all zonule boundaries are taken at an arbitrary point between two samples and are therefore approximate.

2. THE FORAMINIFERAL SEQUENCE

Nerita -1 began drilling in Lower Miocene silty clays, and penetrated an unknown thickness of Miocene and Oligocene sediments before the first cutting returns at 620 feet. A sample at 4'10" in sea bottom core 5 contained a rich planktonic fauna, including *Globigerinoides glomerosa curva*, *Globigerinoides bispherica* and *Globigerinoides triloba*, indicating Zonule F (highest Lower Miocene). This seafloor outcrop was overlain in places by a thin veneer of Recent sand.

Sidewall samples at 672 and 764 feet contain a Middle Oligocene (Zonule 12) fauna. Dominant planktonic species are *Globigerina ampliapertura* and *Globorotalia extans*, while benthonics include *Bolivina anastomosa*, *Cibicides perforatus*, *Anomalina macraglabra*, and *Anomalinoides procolligera*.

A sidewall core at 808 feet contains *Globigerina cf. angiporoides*, *Globorotalia opima*, *Globoquadrina larmeui*, and *Cerobertina kakahoica*, indicating Lower Oligocene Zonule J. Sidewall cores at 946 and 1090 feet also contain good Zonule J faunas, including *Globigerina angiporoides* and *Planorbulinella johannae*. The highest appearance of *Chiloguembelina cubensis* is in a sidewall core at 1035 feet. The index fossil for the zone, *Globorotalia testarugosa*, was not positively identified in any sample. The *Bolivina pontis* stage of the *B. pontis - B anastomosa* lineage appears at 1090 feet, very close to the base of Zonule J.

The top of the Eocene is defined by the first appearance of *Globigerina linaperta* at 1100 feet. A rich Zonule K fauna continues down to 1650 feet. The fauna of the upper part of the zonule includes *Globigerina linaperta*, *G. euapertura*, *G. ampliapertura*, *G. angiporoides*, *Globorotalia cf. munda*, *G. extans*, and *Chiloguembelina cubensis*. Benthonic species include *Bolivina pontis*, *Cerobertina kakahoica*, *Cibicides perforatus*, *Cibicides vortex*, *Uvigerina sp. 1*, and *Angulogerina ototara*.

Below 1300 feet an important element of the planktonic population is a globigerinid closely resembling Globigerapsis index, but lacking supplementary apertures on the spiral side of the test. The species has been noted in Upper Eocene deposits of Zonule M age from Browns Creek, in the Aire district, but its stratigraphic range is not known. Because of its broad morphological similarity to Globigerapsis index, it has been designated "Globigerapsis sp." in this report, although it may be a Globigerina.

Below 1400 feet there is a gradual increase in the number of species and individuals of arenaceous foraminifera. Dorothia cf. minima, Textularia spp., Haplophragmoides cf. incisa and H. rotundata become prominent below 1550 feet, reflecting a shallower facies.

The top of Upper Eocene Zonule L is marked at about 1650 feet by the appearance of Globigerapsis index. "Globigerapsis sp.", Globigerina ampliapertura, Catapsydrax unicavus and rare Globorotalia spp. complete the rather sparse planktonic assemblage. Between 1700 and 1950 feet calcareous benthonic species Spirillina spp., Robulus sp., Cassidulinoides subglobosa and miliolids, along with arenaceous species, reflect shallow water conditions.

A cutting sample at 2000 feet contains a fauna of over 50% arenaceous species, and below this depth the total number of foraminifera falls off sharply. No foraminifera were found in a sidewall core at 2035 feet, or in any deeper sidewall cores. Thus the foraminiferal succession is believed to end just below 2000'.

3. BIOSTRATIGRAPHIC INTERPRETATION (Paleontology and Palynology).

The Upper Cretaceous part of the sequence appears to be almost entirely continental; neither foraminifera nor microplankton were found in sidewall cores between 4245 and 4782', except for sparse microplankton in the lowest core. Glauconite and ripple marks also suggest limited marine influence in the sediments overlying the Otway group.

The boundary between the Tertiary and Cretaceous cannot yet be accurately fixed by palynological analysis. As in Pecten-1A there is a zone which may be assigned to either the lowermost Tertiary or uppermost Cretaceous. There appears to be no palynological or lithological evidence for an unconformity between Tertiary and Cretaceous in Nerita -1.

The top of the continental Paleocene sequence is above 2570' (see Appendix VI). Sidewall cores between 2106' and 2496' contain an Eocene pollen assemblage assigned to Cookson's Assemblage C. The flora suggests that these samples belong to the Upper Eocene part of this assemblage, and the Upper Eocene foraminiferal sequence begins at round 2000'. The evidence suggests that a hiatus existed during Lower and possibly Middle Eocene times; and that it is represented by a depositional break within the interval 2496' - 2570'.

The marine succession in Nerita -1 began in Upper Eocene (Zonule L) times, just above the base of the dark siltstones of the Demon's Bluff formation. (This is slightly earlier than the onset of marine sedimentation in the Bass Basin.) The high proportion of arenaceous and certain calcareous benthonic species indicates shallow water conditions between 2000 and 1700 feet. Planktonic species are rare at first, and increase steadily up the sequence. A continuous slow sinking of the depositional area is indicated from Zonule L time until shortly before the end of the Eocene. Open marine circulation began to influence the composition offaunas soon after marine deposition began.

Near the end of the Eocene, the relatively uniform deep water facies of the Demon's Bluff formation is disturbed by uplift. A series of thinly interbedded sands, silts and marls forms a transition between the siltstone sequence and the dominantly carbonate Torquay group. The Eocene - Oligocene boundary falls within these transition beds, and deposition appears to be continuous. A continuous sequence is also present at Bell's Headland, in the Torquay district. Elsewhere the boundary between the Torquay group and the Demon's Bluff formation is a disconformity.

After the deposition of the very shallow water transitional beds, there is a return to deeper marine conditions during Zonule J and I 2 times with the deposition of the Torquay group.

The rich planktonic fauna and fine-grained silty clay of the Lower Miocene sea floor cores indicates a rather deep shelf environment little influenced by current sorting, and probably distant from sources of detrital supply.

RANGE CHART OF SIGNIFICANT FORAMINIFERA FROM NERITA -1

(See also enclosure 1 for more detailed distribution)

Appendix V Fig 1

SPECIES

PLANKTONICS

- *Globigerinoides glomerosus*
- *G. triloba*
- *Globigerina apertura*
- *G woodi*
- *G bulloides*
- *Globorotalia menardii group*
- *Globigerina euapertura*
- *G ampliapertura*
- *Globoquadrina larmeui*
- *Globorotalia opima group*
- *G obesa*
- *Globigerina angiporoides*
- *G. linaperta*
- *Catapsydrax unicavus*
- *Chiloguembelina cubensis*
- *"Globigerapsis sp."*
- *Globigerapsis index*
- *Hastigerina micra*

BENTHONICS

- *Bolivina anastomosa*
- *B. pontis*
- *Cerobertina kakahoica*
- *Uvigerina sp.1*
- *Angulogerina ototara*
- *Cibicides sp.1*

DEPTH BDF.	400	600	(790) 800	1000	(1100) 1200	1400	(1640) 1600	1800	2000
ZONULE	F	?	I	J	K	L
AGE	LOWER MIOCENE	No samples	MIDDLE OLIGOCENE	LOWER OLIGOCENE	UPPER EOCENE	

Drawing 1238

PE904987

This is an enclosure indicator page.
The enclosure PE904987 is enclosure within the
container PE900432 at this location in this document.

The enclosure PE904987 has the following characteristics:

ITEM_BARCODE	=	PE904987
CONTAINER_BARCODE	=	PE900432
NAME	=	Nerita 1 Appendix V Enclosure 1 Distribution of Selected Foraminifera
BASIN	=	OTWAY
PERMIT	=	
TYPE	=	WELL
SUBTYPE	=	DIAGRAM
DESCRIPTION	=	Nerita 1 Appendix V Enclosure 1 Distribution of Selected Foraminifera
DATE_CREATED	=	
DATE_RECEIVED	=	
W_NO	=	W508
WELL_NAME	=	Nerita-1
CONTRATOR	=	
CLIENT_OP_CO	=	Shell

PE902964

This is an enclosure indicator page.
The enclosure PE902964 is enclosure within the
container PE900432 at this location in this document.

The enclosure PE902964 has the following characteristics:

ITEM_BARCODE	=	PE902964
CONTAINER_BARCODE	=	PE900432
NAME	=	Nerita 1 Appendix V Enclosure 1 Distribution of Selected Foraminifera
BASIN	=	OTWAY
PERMIT	=	
TYPE	=	WELL
SUBTYPE	=	DIAGRAM
DESCRIPTION	=	Nerita 1 Appendix V Enclosure 1 Distribution of Selected Foraminifera (2nd copy)
DATE_CREATED	=	
DATE_RECEIVED	=	
W_NO	=	W508
WELL_NAME	=	Nerita-1
CONTRATOR	=	
CLIENT_OP_CO	=	Shell

PALYNOLOGICAL REPORT ON SHELL

NERITA NO. 1 WELL, 2106-6456 FEET

by

Dr. M.E. Dettmann
University of Queensland

Test Figures

Table 1 : Preservation and zonal attribution of plant microfossil assemblages in sidewall cores of Nerita No. 1 well, 2106 feet - 6456 feet.

Enclosure

1. Distribution of Microflora from Nerita -1

PALYNOLOGICAL REPORT ON SHELL NERITA NO.1 WELL

2106 - 6456 FEET

by

Dr. M.E. Dettmann

A palynological analysis of twenty five sidewall cores taken from between 2106 feet and 6456 feet in Nerita No.1 well forms the basis of the present account. Extraction of the palynological floras from the samples examined involved an initial treatment in cold hydrofluoric acid followed by mineral separation with zinc bromide. The residues were then examined and the quality of preservation of the contained plant microfossils was ascertained (see Table 1). A subsequent treatment with Schulze solution for five to fifteen minutes followed by brief immersion in $\frac{1}{2}$% ammonium hydroxide was carried out on all residues before the microfloral suites were specifically analysed.

All samples were found to contain spores and pollen grains together with varying amounts of wood and cuticular fragments. Microplankton are of intermittent occurrence in the section between 2106 feet and 4782 feet and when present occur in strictly minor proportions. The spore - pollen - microplankton suites identified in the samples are tabulated below with reference to their qualitative and quantitative content; the quantitative estimates are expressed in the following terms:- Ab (abundant) - numerical representation of a particular species totals at least 5% of total microflora, C (common) - numerical representation of a species forms 1 - 5% of total microflora, and R (rare) - numerical representation of a species forms less than 1% of total microflora.

As outlined subsequently the Nerita No.1 microfloras possess features diagnostic of certain of the palynological assemblages delineated by Cookson (1954), Harris (1965), Evans (1966) and Dettmann and Playford (1968) in sediments of Lower Tertiary and Cretaceous age of the Otway Basin. An evaluation of this microfloral evidence clearly indicates that the section between 4804 feet and 6456 feet is Lower Cretaceous (mostly, if not all Upper Aptian) in age, and the overlying sediments between 2106 feet and 4782 feet range in age from Senonian to Eocene.

MICROFLORAL CONTENT AND AGE OF SAMPLES

A. 2106 feet - 2496 feet

2106 feet

An excellently preserved and diverse assemblage of abundant spores and pollen grains and rare microplankton was extracted from the sample. Species identified include:

Spores:	Baculatisporites comaumensis (Cookson)	C
	Cyathidites splendens Harris	R
	Gleicheniidites circinidites (Cookson)	R
	Laevigatosporites major (Cookson)	R
	L. ovatus Wilson & Webster	C
	Stereisporites antiquasporites (Wilson & Webster)	C
	Stereisporites sp.	R
	Trilites kopukuensis Couper	R

Pollen:	Casuarinidites cainozoicus Cookson & Pike	R
	Dacrydiumites florinii Cookson & Pike	C
	Duplopollis orthoteichus (Cookson & Pike)	R
	Microcachryidites antarcticus Cookson	R
	Myrtaceidites parvus Cookson & Pike	R
	Nothofagidites emarcidus (Cookson)	C
	Nothofagus cincta Cookson	R
	Podocarpidites ellipticus Cookson	C
	Polyporina fragilis Harris	C
	Proteacidites annularis Cookson	C
	P. adenanthoides Cookson	R
	P. crassus Cookson	C
	P. crassipora Harris	R
	P. dilwynensis Harris	C
	P. grandis Cookson	R
	P. reticuloscabratus Harris	R
	P. rectomarginus Cookson	R
	P. subscabratus Couper	C
	P. sp.	R
	Tricolporites prolata Cookson	C
	Triorites harrisii Couper	Ab

The microfloral assemblage includes Duplopollis orthoteichus together with Proteacidites dilwynensis and conforms with Harris's (1965) Duplopollis orthoteichus Assemblage which is regarded to be of Upper Paleocene age.

C. 2682 feet

Poor concentrations of well preserved spores, pollen, and microplankton were recovered from the sample. Species identified include:

Spores:	Baculatisporites comaumensis (Cookson)	R
	Cyathidites australis Couper	C
	C. splendens Harris	R
	Gleicheniidites circinidites (Cookson)	C
	Stereisporites antiquasporites (Wilson & Webster)	C
Pollen:	Araucariacites australis Cookson	R
	Dacrydiumites florinii Cookson & Pike	C
	Monosulcites prominatus McIntyre	R
	Nothofagidites emarcidus (Cookson)	C
	Podocarpidites ellipticus Cookson	Ab
	Proteacidites crassipora Harris	C
	Tricolporites prolata Cookson	R
	Tricolpites sp.	R
Microplankton:	Cordosphaeridium capricornum Cookson & Eisenack	R

Although lacking both Duplopollis orthoteichus and Triorites edwardsii, the microflora is assigned to Harris's (1965) D. orthoteichus - T. edwardsii Concurrent Assemblage on the basis of Monosulcites prominatus (= Baltisphaeridium taylorii Cookson & Eisenack). This species appears to be restricted to western Victorian strata of Middle - Upper Paleocene age (Cookson and Eisenack 1965b, 1967).

The single species of microplankton recorded from the sample is also known from Middle - Upper Paleocene strata and extends into the Eocene (Cookson and Eisenack 1965a, 1967).

Pollen:	Anacolosidites luteoides Cookson & Pike	R
	Araucariacites australis Cookson	R
	Casuarinidites cainozoicus Cookson & Pike	R
	Duplopollis orthoteichus (Cookson & Pike)	R
	Dacrydiumites florinii Cookson & Pike	C
	Myrtaceidites eugeniioides Cookson & Pike	R
	cf. Malvacipollis diversus Harris	C
	Nothofagidites brachyspinulosus (Cookson)	R
	N. emarcidus (Cookson)	Ab
	Nothofagus diminuta Cookson	C
	Phyllocladidites mawsonii Cookson	C
	Polyporina fragilis Harris	R
	Podosporites microsaccatus Couper	R
	Podocarpidites ellipticus Cookson	C
	Proteacidites adenanthoides Cookson	R
	P. annularis Cookson	C
	P. grandis Cookson	R
	P. cf. pachypolus Cookson & Pike	R
	Santalumidites cainozoicus Cookson & Pike	R
	Tricolporites prolata Cookson	C
	Triorites harrisii Couper	Ab
	T. magnificus Cookson	R
Microplankton:	Cordosphaeridium capricornum Cookson & Eisenack	R
	Cannosphaeropsis cf. densiradiata Cookson & Eisenack	R

2270 feet

The following species of excellently preserved spores, pollen, and microplankton were identified in the residue:

Spores:	Cyathidites australis Couper	C
	C. minor Couper	C
	Laevigatosporites major (Cookson)	R
	L. ovatus Wilson & Webster	C
	Stereisporites antiquasporites (Wilson & Webster)	C
	Trilites kopukuensis Couper	C
Pollen:	Araucariacites australis Couper	C
	Casuarinidites cainozoicus Cookson & Pike	R
	Dacrydiumites florinii Cookson & Pike	C
	Duplopollis orthoteichus (Cookson & Pike)	R
	cf. Malvacipollis diversus Harris	C
	Myrtaceidites eugeniioides Cookson & Pike	R
	Microcachryidites antarcticus Cookson	R
	Nothofagidites emarcidus (Cookson)	C
	Nothofagus aspera Cookson	R
	N. cincta Cookson	R
	N. diminuta Cookson	C
	N. goniata Cookson	R
	Phyllocladidites mawsonii Cookson	C
	Podocarpidites ellipticus Cookson	C
	Polyporina fragilis Harris	R
	Proteacidites annularis Cookson	C
	P. cf. crassus Cookson	R
	P. grandis Cookson	R
	P. incurvatus Cookson	R
	P. pachypolus Cookson & Pike	R
	P. subscabratus Couper	R
	Santalumidites cainozoicus Cookson & Pike	R
	Tricolporites prolata Cookson	C
	Tricolpites thomasii Cookson & Pike	R
	Triorites harrisii Couper	Ab
Microplankton:	Cordosphaeridium capricornum Cookson & Eisenack	R

2496 feet

Spores and pollen grains exhibiting excellent preservation constitute the following microfloral assemblage:

Spores:	Cyathidites minor Couper	C
	C. splendens Harris	R
	Gleicheniidites circinidites (Cookson)	C
	Laevigatosporites major (Cookson)	R
	Verrucatosporites speciosus Harris	C
Pollen:	Anacolosidites luteoides Cookson & Pike	R
	Araucariacites australis Cookson	R
	Dacrydiumites florinii Cookson & Pike	R
	Duplopollis orthoteichus (Cookson & Pike)	R
	Ephedra notensis Cookson	R
	Myrtaceidites eugenioides Cookson & Pike	R
	cf. Malvacipollis diversus Harris	C
	Nothofagidites emarcidus (Cookson)	Ab
	Nothofagus diminuta Cookson	C
	Phyllocladidites mawsonii Cookson	C
	Podocarpidites ellipticus Cookson	C
	Proteacidites annularis Cookson	C
	P. grandis Cookson	C
	P. ornatus Harris	R
	P. pachypolus Cookson & Pike	Ab
	P. rectomarginus Cookson	R
	P. reticuloscabratus Couper	R
	P. subscabratus Couper	C
	P. symphyonemoides Cookson	R
	Santalumidites cainozoicus Cookson & Pike	R
	Tricolporites prolata Cookson	R
	Triorites harrisii Couper	Ab
	Tiliaepollenites notabilis Harris	R

Spore - pollen suites extracted from samples between 2106 feet and 2496 feet include Triorites magnificus, Tricolpites thomasii, Nothofagus aspera, N. diminuta, Proteacidites pachypolus, and Santalumidites cainozoicus and are thus closely conformable with Cookson's (1954) Microflora C which is considered to be of Eocene age. Moreover, except for P. pachypolus, the species cited above are considered by Harris (1965) to distinguish Microflora C from his older (Upper Paleocene) Duplopollis orthoteichus Assemblage which, as discussed below, occurs in underlying sediments in Nerita No.1 well.

The rare microplankton recovered from the samples at 2106 feet and 2270 feet are known from the Lower Tertiary of western Victoria in both Paleocene and Eocene strata (Cookson and Eisenack 1965a, 1967).

B. 2570 feet

Extremely well preserved spores and pollen grains extracted from the sample constitute the following diverse assemblage:

Spores:	Baculatisporites comaumensis (Cookson)	R
	Cyathidites australis Couper	Ab
	C. splendens Harris	R
	Gleicheniidites circinidites (Cookson)	C
	Laevigatosporites ovatus Wilson & Webster	C
	Lycopodiumsporites sp.	R
	Stereisporites sp.	R
	Trilites tuberculiformis Cookson	R

D. 2846 feet - 4065 feet

2846 feet

Well preserved spores and pollen grains extracted from the sample constitute the following diverse assemblage:

Spores:	Baculatisporites comaumensis (Cookson)	R
	Camarozonosporites bullatus Harris	R
	Cyathidites minor Couper	C
	Gleicheniidites circinidites (Cookson)	C
	Latrobosporites crassus Harris	R
	Laevigatosporites ovatus Wilson & Webster	C
	Lycopodiumsporites sp.	R
	Stereisporites sp.	C
	Trilites tuberculiformis Cookson	R
Pollen:	Araucariacites australis Cookson	R
	Dacrydiumites florinii Cookson & Pike	C
	Microcachryidites antarcticus Cookson	C
	Myrtaceidites parvus Cookson & Pike	R
	Nothofagidites cf. brachyspinulosus (Cookson)	R
	N. emarcidus (Cookson)	C
	Phyllocladidites mawsonii Cookson	Ab
	P. reticulosaccatus Harris	R
	Podocarpidites ellipticus Cookson	C
	Polyporina fragilis Harris	C
	Proteacidites annularis Cookson	R
	P. crassus Cookson	R
	P. incurvatus Cookson	R
	P. ornatus Harris	R
	P. reticuloscabratus Harris	R
	P. subscabratus	C
	P. symphyonemoides Cookson	R
	Stephanoporopollenites obscurus Harris	R
	aff. Triorites edwardsii Cookson & Pike	R
	Tricolpites gillii Cookson	R

3048 feet

The following forms of well preserved spores and pollen grains were observed in the residue:

Spores:	Cyathidites australis Couper	C
	C. splendens Harris	R
	Gleicheniidites circinidites (Cookson)	C
	Latrobosporites crassus Harris	R
	Laevigatosporites ovatus Wilson & Webster	C
	Stereisporites antiquasporites (Wilson & Webster)	C
	Trilites tuberculiformis Cookson	R
Pollen:	Banksieaeidites sp.	R
	Dacrydiumites florinii Cookson & Pike	C
	Microcachryidites antarcticus Cookson	C
	Nothofagidites cf. brachyspinulosus (Cookson)	R
	N. emarcidus (Cookson)	C
	Phyllocladidites mawsonii Cookson	Ab
	Podocarpidites ellipticus Cookson	C
	Podosporites microsaccatus Couper	R
	Polyporina fragilis Harris	R
	Proteacidites annularis Cookson	C
	P. dilwynensis Harris	R
	P. subscabratus Couper	C
	Stephanoporopollenites obscurus Harris	R

3149 feet

A diverse assemblage of well preserved spores and pollen was obtained from the sample. The following species were observed:

Spores:	Baculatisporites comaumensis (Cookson)	R
	Camarozonosporites bullatus Harris	R
	C. cf. ohaiensis (Couper)	R
	Cyathidites australis Couper	C
	C. splendens Harris	R
	Gleicheniidites circinidites (Cookson)	Ab
	Latrobosporites crassus Harris	R
	Laevigatosporites ovatus Wilson & Webster	C
	Lycopodiumsporites austroclavatidites (Cookson)	R
	Stereisporites antiquasporites (Wilson & Webster)	C
	Stereisporites sp.	R
	Trilites tuberculiformis Cookson	R
Pollen:	Araucariacites australis Cookson	R
	Dacrydiumites florinii Cookson & Pike	C
	Microcachryidites antarcticus Cookson	C
	Nothofagidites cf. brachyspinulosus (Cookson)	R
	N. emarcidus (Cookson)	C
	Phyllocladidites mawsonii Cookson	Ab
	P. reticulosaccatus Harris	R
	Polyporina fragilis Harris	C
	Proteacidites annularis Cookson	C
	P. crassus Cookson	R
	P. ornatus Harris	R
	P. reticuloscabratus Harris	R
	P. subscabratus Couper	Ab
	Stephanoporopollenites obscurus Harris	R
	aff. Triorites edwardsii Cookson & Pike	R

3253 feet

The following species of spores and pollen grains were observed in the residue:

Spores:	Baculatisporites comaumensis (Cookson)	R
	Camarozonosporites cf. ohaiensis (Couper)	R
	Cyathidites australis Couper	C
	C. splendens Harris	R
	Gleicheniidites circinidites (Cookson)	C
	Laevigatosporites ovatus Wilson & Webster	C
	Stereisporites antiquasporites (Wilson & Webster)	C
	Stereisporites sp.	R
	Trilites tuberculiformis Cookson	R
Pollen:	Araucariacites australis Cookson	R
	Microcachryidites antarcticus Cookson	C
	Nothofagidites emarcidus (Cookson)	C
	Phyllocladidites mawsonii Cookson	Ab
	Proteacidites crassus Cookson	R
	P. dilwynensis Harris	R
	P. subscabratus Couper	Ab
	Triorites edwardsii Cookson & Pike	R
	aff. T. edwardsii Cookson & Pike	R
Remanié:	Cicatricosisporites ludbrooki Dettmann - Lower Cretaceous	
	Nuskoisporites sp. - Permian	

3531 feet

A diverse assemblage composed of the following well preserved forms of spores and pollen was extracted from the sample:

Spores:	Baculatisporites comaumensis (Cookson)	R
	Cyathidites australis Couper	C
	C. splendens Harris	R
	Camarozonosporites amplus (Stanley)	R
	Gleicheniidites circinidites (Cookson)	C
	Laevigatosporites major (Cookson)	R
	L. ovatus Wilson & Webster	R
	Stereisporites antiquasporites (Wilson & Webster)	C
	Trilites tuberculiformis Cookson	R
Pollen:	Dacrydiumites ellipticus Harris	R
	D. florinii Cookson & Pike	C
	Microcachryidites antarcticus Cookson	C
	Nothofagidites emarcidus (Cookson)	C
	Phyllocladidites mawsonii Cookson	Ab
	P. reticulosaccatus Harris	R
	Podocarpidites ellipticus Cookson	C
	Podosporites microsaccatus (Couper)	R
	Polyporina fragilis Harris	R
	Proteacidites annularis Cookson	R
	P. crassus Cookson	R
	P. crassipora Harris	R
	P. reticuloscabratus Harris	R
	P subscabratus Couper	Ab
	Stephanoporopollenites obscurus Harris	C

3704 feet

A well preserved assemblage composed of abundant spores and pollen grains and rare microplankton was recovered from the sample. The following species were identified:

Spores:	Baculatisporites comaumensis (Cookson)	R
	Cyathidites australis Couper	C
	C. splendens Harris	R
	Gleicheniidites circinidites (Cookson)	C
	Laevigatosporites ovatus Wilson & Webster	C
	Stereisporites antiquasporites (Wilson & Webster)	Ab
Pollen:	Araucariacites australis Cookson	R
	Dacrydiumites ellipticus Harris	R
	D. florinii Cookson & Pike	R
	Microcachryidites antarcticus Cookson	C
	Nothofagidites cf. brachyspinulosus (Cookson)	R
	N. emarcidus (Cookson)	C
	Phyllocladidites mawsonii Cookson	Ab
	P. paleogenicus (Cookson)	R
	Podocarpidites ellipticus Cookson	C
	Podosporites microsaccatus (Couper)	R
	Polyporina fragilis Harris	R
	Proteacidites annularis Cookson	R
	P. subscabratus Couper	C
Microplankton:	Deflandrea dilwynensis Cookson & Eisenack	R

3867 feet

The sample contains a restricted microflora in which the following well preserved species were identified:

Spores:	Baculatisporites comaumensis (Cookson)	R
	Cyathidites australis Couper	C
	C. splendens Harris	R
	Gleicheniidites circinidites (Cookson)	C
	Stereisporites antiquasporites (Wilson & Webster)	Ab
Pollen:	Araucariacites australis Cookson	R
	Dacrydiumites balmei Cookson	R
	D. florinii Cookson & Pike	R
	Microcachryidites antarcticus Cookson	C
	Nothofagidites emarcidus (Cookson)	R
	Phyllocladidites mawsonii Cookson	C
	Podocarpidites ellipticus Cookson	C
	Podosporites microsaccatus (Couper)	C
	Proteacidites parvus Cookson	R
	P. subscabratus Couper	C
	Stephanoporopollenites obscurus Harris	R
Remanie:	Nuskoisporites sp. - Permian	R

4065 feet

Well preserved spores and pollen grains extracted from the sample constitute the following assemblage:

Spores:	Camarozonosporites bullatus Harris	C
	Cyathidites australis Couper	C
	C. splendens Harris	R
	Gleicheniidites circinidites (Cookson)	C
	Kraeuselisporites papillatus Harris	R
	Laevigatosporites major (Cookson)	R
	L. ovatus Wilson & Webster	C
	Stereisporites antiquasporites (Wilson & Webster)	Ab
	Stereisporites sp.	C
Pollen:	Dacrydiumites florinii Cookson & Pike	R
	Liliacidites sp.	R
	Microcachryidites antarcticus Cookson	C
	Phyllocladidites mawsonii Cookson	Ab
	Podocarpidites ellipticus Cookson	C
	Podosporites microsaccatus (Couper)	R
	Proteacidites cf. rectomarginus Cookson	R
	P. subscabratus Couper	Ab
	Triorites edwardsii Cookson & Pike	R
	aff. T. edwardsii Cookson & Pike	R
	Tricolpites gillii Cookson	R
	T. pachyexinus Couper	R

The microflora from 2846 feet possesses features of both the Triorites edwardsii Assemblage and the T. edwardsii - D. orthoteichus Concurrent Assemblage. The youngest occurrences of T. edwardsii (s.l.) and Phyllocladidites reticulosaccatus characterise the Concurrent Assemblage and were noted in the sample at 2846 feet. This horizon also yielded Proteacidites incurvatus recorded by Harris (1965) only from his D. orthoteichus Assemblage and Camarozonosporites bullatus which, however, is apparently restricted to the T. edwardsii Assemblage. Thus, the microflora at 2846 feet is only tentatively assigned to the T. edwardsii Assemblage.

Sediments between 3048 feet and 3704 feet yielded microfloras that are assignable to the T. edwardsii Assemblage which is dated as Middle Paleocene (Harris 1965) although its lower age limit has not been fully evaluated. Nevertheless, the occurrence of Triorites edwardsii, Dacrydiumites ellipticus, and Camarozonosporites bullatus in association with Phyllocladidites reticulosaccatus down to 3531 feet and the presence of Deflandrea dilwynensis at 3704 feet support a Middle Paleocene age for sediments between 3048 feet and 3704 feet. The last mentioned species is known only from Middle Paleocene deposits (Cookson & Eisenack 1965c) and Harris indicates that Phyllocladidites reticulosaccatus does not extend into the basal horizons from which he described the T. edwardsii Assemblage. The occurrence of the T. edwardsii Assemblage in Nerita No.1 well between 3048 feet and 3704 feet indicates that at least part of the sequence is equivalent to sediments at 3618 feet in Pecten -1A well (Dettmann 1967a).

The sample at 3867 feet yielded a restricted microflora in which Dacrydiumites balmei is a component. The microflora may thus be assigned to the T. edwardsii Assemblage although the species is now believed to extend into sediments that may be either of earliest Tertiary or latest Cretaceous age (Dettmann 1967a). The microflora at 4065 feet also shows characteristics of both late Cretaceous and early Tertiary assemblages and is similar to those obtained from Pecten -1A well at 3735 feet and 3797 feet (Dettmann 1967 a,b).

E. 4245 feet - 4782 feet

4245 feet

A well preserved assemblage composed of the following species of spores and pollen grains was extracted from the sample:

Spores:	Camarozonosporites amplus (Stanley)	R
	Cyathidites australis Couper	C
	C. splendens Harris	R
	Gleicheniidites circinidites (Cookson)	C
	Laevigatosporites ovatus Wilson & Webster	R
	Stereisporites antiquasporites (Wilson & Webster)	C
	Verrucatosporites speciosus Harris	R
Pollen:	Araucariacites australis Cookson	R
	Dacrydiumites florinii Cookson & Pike	R
	Nothofagidites emarcidus (Cookson)	C
	N. senectus Dettmann & Playford	R
	Phyllocladidites mawsonii Cookson	C
	Podocarpidites ellipticus Cookson	C
	Podosporites microsaccatus (Couper)	R
	Proteacidites scaboratus Couper	C
	P. subscabratus Couper	Ab
	Tricolpites gillii Cookson	R
	T. lillei Couper	R
	T. pachyexinus Couper	C

4273 feet

The sample yielded a rich microflora in which the following spore and pollen species were identified:

Spores:	Camarozonosporites amplus (Stanley)	R
	Cyathidites australis Couper	C
	C. splendens Harris	R
	Gleicheniidites circinidites (Cookson)	C
	Laevigatosporites major (Cookson)	R
	L. ovatus Wilson & Webster	Ab
	Lycopodiumsporites austroclavatidites (Cookson)	R
	Stereisporites antiquasporites (Wilson & Webster)	Ab
	Verrucatosporites speciosus Harris	R

Pollen:	Cycadopites nitidus (Balme)	R
	Microcachryidites antarcticus Cookson	C
	Nothofagidites emarcidus (Cookson)	R
	N. senectus Dettmann & Playford	C
	Phyllocladidites mawsonii Cookson	C
	Podocarpidites ellipticus Cookson	C
	P. exiguus Harris	C
	Podosporites microsaccatus (Couper)	R
	Proteacidites amolosexinus Dettmann & Playford	R
	P. subscabratus Couper	C
	Tricolpites gillii Cookson	R
	T. pachyexinus Couper	C
	T. sabulosus Dettmann & Playford	R
	Triorites edwardsii Cookson & Pike	R
	aff. T. edwardsii Cookson & Pike	R
Remanié:	Aequitriradites spinulosus (Cookson & Dettmann) - Lower Cretaceous	

4534 feet

Fair concentrations of the following species of well preserved spores and pollen grains were observed in the residue:

Spores	Camarozonosporites amplus (Stanley)	R
	Cyathidites australis Couper	C
	C. splendens Harris	R
	Gleicheniidites circinidites (Cookson)	C
	Laevigatosporites ovatus Wilson & Webster	C
	Lycopodiumsporites austroclavatidites (Cookson)	R
	Stereisporites antiquasporites (Wilson & Webster)	Ab
Pollen:	Araucariacites australis Cookson	R
	Microcachryidites antarcticus Cookson	C
	Nothofagidites emarcidus (Cookson)	R
	N. senectus Dettmann & Playford	C
	Phyllocladidites mawsonii Cookson	C
	Podocarpidites ellipticus Cookson	C
	P. marwickii Couper	R
	P. exiguus Harris	R
	Podosporites microsaccatus (Couper)	R
	Proteacidites amolosexinus Dettmann & Playford	R
	P. scaboratus Couper	R
	P. subscabratus Couper	Ab
	Tricolpites gillii Cookson	R
	T. pachyexinus Couper	R
	T. sabulosus Dettmann & Playford	C
Remanié:	Aequitriradites spinulosus (Cookson & Dettmann) - Lower Cretaceous	
	Cicatricosisporites ludbrooki Dettmann - Lower Cretaceous	

4660 feet

The following species of well preserved spores and pollen grains were identified in the residue:

Spores:	Baculatisporites comaumensis (Cookson)	R
	Camarozonosporites amplus (Stanley)	R
	Cyathidites australis Couper	C
	Ceratosporites sp.	R
	Laevigatosporites ovatus Wilson & Webster	C
	Stereisporites antiquasporites (Wilson & Webster)	Ab

Pollen:	Araucariacites australis Cookson	R
	Microcachryidites antarcticus Cookson	C
	Nothofagidites senectus Dettmann & Playford	C
	Phyllocladidites mawsonii Cookson	C
	Podocarpidites ellipticus Cookson	C
	Podosporites microsaccatus (Couper)	R
	Proteacidites amolosexinus Dettmann & Playford	R
	P. subscabratus Couper	C
	Triorites minor Couper	R
	aff. Triorites edwardsii Cookson & Pike	R
	Tricolpites gillii Cookson	R
	T. pachyexinus Couper	C
	T. sabulosus Dettmann & Playford	C

4782 feet

Spores, pollen, and microplankton were extracted from the sample and constitute the following assemblage:

Spores:	Camarozonosporites amplus (Stanley)	R
	Clavifera triplex (Bolkhovitina)	R
	Cyathidites australis Couper	R
	Gleicheniidites circinidites (Cookson)	C
	Stereisporites antiquasporites (Wilson & Webster)	Ab
	S. viriosus Dettmann & Playford	R
Pollen:	Araucariacites australis Cookson	R
	Microcachryidites antarcticus Cookson	C
	Phyllocladidites mawsonii Cookson	R
	Podocarpidites ellipticus Cookson	C
	Podosporites microsaccatus (Couper)	R
	Proteacidites scaboratus Couper	R
	P. subscabratus Couper	C
	Tricolpites pachyexinus Couper	C
	T. sabulosus Dettmann & Playford	R
	Triorites minor Couper	R
Microplankton:	Hystrichosphaeridium heteracanthum Deflandre & Cookson	R
Remanié:	Aratrisporites sp. - Triassic	

Sediments between 4245 feet and 4782 feet are dated as Upper Cretaceous (Senonian and later) on the basis of their content of spore-pollen assemblages diagnostic of Dettmann & Playford's (1968) Nothofagidites Microflora. Assemblages extracted from sediments between 4245 feet and 4660 feet contain Nothofagidites senectus in association with Triorites edwardsii, aff. T. edwardsii, Tricolpites pachyexinus, T. lillei, T. sabulosus, and Proteacidites amolosexinus. The presence of T. edwardsii and/or aff. T. edwardsii down to 4660 feet indicates that the section may be correlated with sediments in Pecten -1A well between 3833 feet and 4493 feet. (Dettmann 1967a,c).

The sample from 4782 feet did not yield Nothofagidites senectus but contains Tricolpites sabulosus which on present knowledge is restricted to the Nothofagidites Microflora. The rare microplankton recovered from this horizon are represented by one species Hystrichosphaeridium heteracanthum, a type that is of widespread distribution in the Victorian Upper Cretaceous.

F. 4804 feet - 6456 feet

4804 feet

An extremely sparse microflora composed of corroded specimens of spores and pollen grains was extracted from the sample. Species identified include:

Spores:	Cyathidites australis Couper	
	C. minor Couper	
	Ceratosporites equalis Cookson & Dettmann	
	Foraminisporis asymmetricus (Cookson & Dettmann	
	Neoraistrickia truncata (Cookson)	
Pollen:	Araucariacites australis Cookson	
	Alisporites grandis (Cookson)	
	Microcachryidites antarcticus Cookson	
	Podocarpidites cf. ellipticus Cookson	

1944 feet

Reasonably well preserved spores and pollen grains were obtained in low concentrations. The following forms were observed:

Spores:	Aequitriradites spinulosus (Cookson & Dettmann)	R
	Baculatisporites comaumensis (Cookson)	C
	Cyathidites australis Couper	C
	C. minor Couper	C
	C. punctatus (Delcourt & Sprumont)	R
	Ceratosporites equalis Cookson & Dettmann	R
	Cicatricosisporites australiensis (Cookson)	C
	Crybelosporites striatus (Cookson & Dettmann)	R
	Dictyotosporites speciosus Cookson & Dettmann	R
	Lycopodiumsporites austroclavatidites (Cookson)	C
	L. eminulus Dettmann	R
	L. facetus Dettmann	R
	Stereisporites antiquasporites (Wilson & Webster)	Ab
Pollen:	Araucariacites australis Cookson	R
	Alisporites grandis (Cookson)	R
	Classopollis cf. classoides Pflug	C
	Cycadopites nitidus (Balme)	R
	Microcachryidites antarcticus Cookson	C
Remanié:	Aratrisporites sp. - Triassic	

5287 feet

A fairly preserved microflora composed of the following species of spores and pollen grains occur in the sample:

Spores:	Baculatisporites comaumensis (Cookson)	C
	Cingutriletes clavus (Balme)	R
	Cyathidites australis Couper	C
	Dictyotosporites speciosus Cookson & Dettmann	R
	Foraminisporis asymmetricus (Cookson & Dettmann)	R
	F. dailyi (Cookson & Dettmann)	R
	F. wonthaggiensis (Cookson & Dettmann)	R
	Gleicheniidites cf. circinidites (Cookson)	R
	Leptolepidites major Couper	R
	L. verrucatus Couper	R
	Lycopodiumsporites austroclavatidites (Cookson)	C
	L. circolumenus Cookson & Dettmann	R
	L. facetus Dettmann	R
	Neoraistrickia truncata (Cookson)	C
	Stereisporites antiquasporites (Wilson & Webster)	Ab
	Velosporites triquetrus (Lantz)	R
Pollen:	Alisporites grandis (Cookson)	R
	Araucariacites australis Cookson	R
	Classopollis cf. classoides Pflug	C
	Microcachryidites antarcticus Cookson	C
	Podocarpidites cf. ellipticus Cookson	Ab
	Podosporites microsaccatus (Couper)	R

5561 feet

A small residue containing a few specimens of the following spores and pollen grains was extracted from the sample:

Spores:	Cingutriletes clavus (Balme)	
	Cyathidites australis Couper	
	C. minor Couper	
	Stereisporites antiquasporites (Wilson & Webster)	
Pollen:	Microcachryidites antarcticus Cookson	
	Podocarpidites cf. ellipticus Cookson	

5900 feet

The sample provided low concentrations of the following species of fairly preserved spores and pollen grains:

Spores:	Aequitriradites spinulosus (Cookson & Dettmann)	R
	Baculatisporites comaumensis (Cookson)	R
	Cicatricosisporites australiensis	R
	Cyathidites australis Couper	Ab
	C. minor Couper	C
	C. punctatus (Delcourt & Sprumont)	R
	Gleicheniidites cf. circinidites (Cookson)	R
	Kraeuselisporites linearis (Cookson & Dettmann)	R
	Stereisporites antiquasporites (Wilson & Webster)	Ab
Pollen:	Araucariacites australis Cookson	R
	Alisporites grandis (Cookson)	R
	Classopollis cf. classoides Pflug	R
	Microcachryidites antarcticus Cookson	C
	Podocarpidites cf. ellipticus Cookson	Ab
Incertae Sedis:	Schizosporis reticulatus Cookson & Dettmann	R

6068 feet

A diverse assemblage of fairly preserved spores and pollen grains occurs in the sample. Species identified include:

Spores:	Aequitriradites spinulosus (Cookson & Dettmann)	C
	A. verrucosus (Cookson & Dettmann)	C
	Baculatisporites comaumensis (Cookson)	R
	Ceratosporites equalis Cookson & Dettmann	R
	Cicatricosisporites australiensis (Cookson)	C
	Crybelosporites striatus (Cookson & Dettmann)	R
	Cyathidites australis Couper	Ab
	C. minor Couper	C
	C. punctatus (Delcourt & Sprumont)	Ab
	Dictyotosporites speciosus Cookson & Dettmann	R
	Foraminisporis asymmetricus (Cookson & Dettmann)	C
	F. wonthaggiensis (Cookson & Dettmann)	R
	Gleicheniidites cf. circinidites (Cookson)	R
	Leptolepidites verrucatus Couper	R
	Rouseisporites reticulatus Pocock	C
	Stereisporites antiquasporites (Wilson & Webster)	R
Pollen:	Araucariacites australis Cookson	R
	Alisporites grandis (Cookson)	R
	Classopollis cf. classoides Pflug	C
	Microcachryidites antarcticus Cookson	C
	Podocarpidites cf. ellipticus Cookson	C
	Podosporites microsaccatus (Couper)	R

6456 feet

Poorly preserved spores and pollen grains were extracted from the sample and include the following forms:

Spores:	Baculatisporites comaumensis (Cookson)	R
	Ceratosporites equalis Cookson & Dettmann	R
	Cicatricosisporites australiensis (Cookson)	C
	Cyathidites australis Couper	C
	C. minor Couper	R
	Foveosporites canalis Balme	R
	Klukisporites scaberis (Cookson & Dettmann)	R
	Leptolepidites verrucatus Couper	R
	Lycopodiumsporites austroclavatidites (Cookson)	C
	Lycopodiumsporites sp. indet.	R
Pollen:	Araucariacites australis Cookson	R
	Alisporites grandis Cookson	R
	Cycadopites nitidus (Balme)	R
	Microcachryidites antarcticus Cookson	Ab
	Podocarpidites cf. ellipticus Cookson	Ab
	Podosporites microsaccatus (Couper)	R

The sample from 4804 feet yielded only a sparse, poorly preserved microflora which in containing Foraminisporis asymmetricus is clearly of Lower Cretaceous age. However, assignment of the microflora to the spore-pollen assemblages delineated by Dettmann (1963) and Dettmann and Playford (1968) in the Lower Cretaceous of eastern Australia is precluded by the absence of other stratigraphically significant species.

The Crybelosporites striatus Subzone of the Dictyotosporites speciosus Zone is represented in sediments between 4944 feet and 6068 feet. This unit is diagnosed by the presence of C. striatus in association with D. speciosus and is of Upper Aptian age. It was not positively identified in Pecten-1A well but may be represented within the interval 8120 - 9132 feet. (Dettmann 1967c).

The lowest horizon investigated yielded a poorly preserved microflora which in containing Cicatricosisporites australiensis is Lower Cretaceous or at the oldest uppermost Jurassic in age. Other species identified have little stratigraphical value within the late Jurassic and Lower Cretaceous of Australia.

CONCLUSIONS

Palynological evidence indicates that sediments between 4804 feet and 6456 feet in Nerita No.1 well are of Lower Cretaceous age. Moreover, it has been demonstrated that the section between 4944 feet and 6068 feet belongs to the Crybelosporites striatus Subzone of the Dictyotosporites speciosus Zone and is thus of Upper Aptian age. The Lower Cretaceous deposits are overlain by an Upper Cretaceous to Lower Tertiary sequence. Within the younger sequence the Nothofagidites Microflora is represented in horizons between 4245 feet and 4782 feet, thus demonstrating an Upper Cretaceous (Senonian and later) age. Succeeding samples from 3867 feet and 4065 feet contain microfloras suggesting an uppermost Cretaceous or lowermost Tertiary age, whilst the interval between 2846 feet and 3704 feet is dated as Middle Paleocene on the basis of the Triorites edwardsii Assemblage. The Middle-Upper Paleocene Duplopollis orthoteichus - Triorites edwardsii Concurrent Range Zone is probably represented at 2682 feet, and is overlain by sediments at 2570 feet containing the Upper Paleocene Duplopollis orthoteichus Assemblage. Horizons between 2106 feet and 2496 feet yielded microfloral assemblages comparable to Cookson's (1954) Microflora C which is believed to be of Eocene age.

The palynological floras extracted from the Lower Cretaceous sequence are composed entirely of land derived forms which exhibit fair to poor preservation. Remanie fossils of Triassic age occur at the horizon at 4944 feet.

The Upper Cretaceous and Lower Tertiary microfloras are well to excellently preserved and are mostly composed of spores and pollen grains. Microplankton are sparse in the Senonian sample at 4782 feet, in the Middle Paleocene horizon at 3704 feet, and in Eocene sediments at 2106 feet and 2270 feet. Remanie fossils of Lower Cretaceous, Triassic, and Permian age occur spasmodically throughout the Upper Cretaceous - Lower Tertiary sequence.

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8th November, 1967.

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Depth (feet)	Yield	Spore - Pollen		Microplankton		Wood		Cuticle		Spore - Pollen Zone
		Col.	Pres.	Col.	Pres.	Col.	Pres.	Col.	Pres.	
2106	A	LY	exc	LY	exc	DY - Br	fair - good	L - DY	good	*Eocene*
2270	"	"	"	"	"	Br	"	"	"	"
2496	"	"	"	—	—	"	"	"	"	"
2570	"	"	"	—	—	"	"	"	"	*Duplopollis orthoteichus*
2682	S	L - DY	good	LY	good	"	"	"	"	*D. orthoteichus - T. edwardsii*
2846	A	"	"	—	—	"	"	"	"	*? Triorites edwardsii*
3048	C	"	"	—	—	"	"	"	"	*Triorites edwardsii*
3149	A	"	"	—	—	"	"	"	"	" "
3253	C	"	"	—	—	"	"	"	fair - good	" "
3531	"	"	"	—	—	Br - Bl	fair	"	"	" "
3704	"	"	"	DY	good	"	"	"	"	" "
3867	"	"	"	—	—	"	"	"	"	*Lowermost Tertiary - uppermost Cretaceous*
4065	"	"	"	—	—	"	"	"	"	
4245	"	"	"	—	—	"	"	"	"	*Nothofagidites*
4372	A	"	"	—	—	"	"	"	"	"
4534	C	"	"	—	—	"	"	"	"	"
4660	"	"	"	—	—	"	"	"	"	"
4782	S	"	"	DY	good	"	"	"	"	"
4804	"	DY - Br	poor	—	—	"	fair - poor	DY - Br	fair - poor	*? Crybelosporites striatus*
4944	"	"	fair - good	—	—	"	"	"	"	" "
5287	C	"	"	—	—	"	"	"	"	" "
5561	S	"	fair	—	—	"	"	"	"	" "
5900	"	"	fair - poor	—	—	"	"	"	"	" "
6068	A	"	"	—	—	"	"	"	"	" "
6456	C	"	"	—	—	"	"	"	"	*Lower Cretaceous indet.*

Drawing No. 2125

Appendix VI
Table I

EXPLANATION OF TABLE 1

Preservation and zonal attribution of plant microfossil assemblages in sidewall cores of Nerita No.1 well, 2106 feet - 6456 feet.

Abbreviations:

Yield expresses frequency of spores, pollen, and microplankton in the palynological residues as follows:-

Ab	=	abundant
C	=	common
Sp	=	sparse

Colour and Preservation. Spores, pollen, microplankton, wood, and cuticle present in the residues are denoted by their colour (col.) and quality of preservation (pres.) thus:-

LY	=	light yellow
DY	=	dark yellow
Br	=	brown
Bl	=	black
Exc	=	excellent
Good	=	good
Fair	=	fair
Poor	=	poor

Spore-pollen Zones are those defined by Harris (1965) and Dettmann and Playford (1968).

PE904988

This is an enclosure indicator page.
The enclosure PE904988 is enclosure within the
container PE900432 at this location in this document.

The enclosure PE904988 has the following characteristics:

ITEM_BARCODE	=	PE904988
CONTAINER_BARCODE	=	PE900432
NAME	=	Nerita 1 Appendix VI Enclosure 1 Distribution of microflora
BASIN	=	OTWAY
PERMIT	=	
TYPE	=	WELL
SUBTYPE	=	DIAGRAM
DESCRIPTION	=	Nerita 1 Appendix VI Enclosure 1 Distribution of microflora
DATE_CREATED	=	
DATE_RECEIVED	=	
W_NO	=	W508
WELL_NAME	=	Nerita-1
CONTRATOR	=	
CLIENT_OP_CO	=	Shell

PE902962

This is an enclosure indicator page.
The enclosure PE902962 is enclosure within the
container PE900432 at this location in this document.

The enclosure PE902962 has the following characteristics:

ITEM_BARCODE	=	PE902962
CONTAINER_BARCODE	=	PE900432
NAME	=	Nerita 1 Appendix VI Enclosure 1 Distribution of microflora
BASIN	=	OTWAY
PERMIT	=	
TYPE	=	WELL
SUBTYPE	=	DIAGRAM
DESCRIPTION	=	Nerita 1 Appendix VI Enclosure 1 Distribution of microflora (2nd copy)
DATE_CREATED	=	
DATE_RECEIVED	=	
W_NO	=	W508
WELL_NAME	=	Nerita-1
CONTRATOR	=	
CLIENT_OP_CO	=	Shell

PALYNOLOGICAL EXAMINATION OF TERTIARY SAMPLES FROM WELL NERITA -1, OTWAY BASIN, AUSTRALIA

by

B.I.P.M., The Hague

Summary

Results of a palynological examination of cutting samples from well Nerita -1 are correlated with a section described on land from the nearby Princetown area, and the results of the well Pecten -1 previously investigated (Muller, September 1967).

Introduction

Cutting samples were available from 650'-4800'. Some 26 samples have been investigated, allowing sample intervals of 100 to 200 ft., except for the deepest four samples which have all been studied. Plant microfossil content proved to be fair to good. Sporomorph translucency values for pollen and spores fall in the light category (1-1½). Twelve new species have been added to the type-collection, all of which could be referred to published species or genera (Harris, 1965).

Discussion of results

Duplopollis orthoteichus (Pcs.60) could be recognized in the interval 650'-2440', with co-occurrences of Myrtaceidites tenuis (Pcs.51), Duplopollis major (Pcs.45) and in the lowermost samples of the said interval Proteacidites ornatus (po3.92). In addition to these species Santalumidites cainozoicus (Po3.113) occurred in this interval. This species was found by Cookson & Pike (1954) in their microflora "C", which flora was considered by Harris (1965) to be younger than his Duplopollis orthoteichus assemblage-zone. Moreover Proteacidites pachypolus (Po3.47) occurred in two samples below the base of D. orthoteichus (2530' and 2830'). However, these findings could be due to caving, since only cutting material was available for investigation. While D. orthoteichus has not been found in cuttings below 2440', it has been reported in sidewall samples down to 2570'. The evidence from cuttings, therefore, cannot be considered diagnostic for determination of the limits of the Duplopollis orthoteichus assemblage zone.

The top occurrence of Triorites edwardsii (po3.20) was found at 3750', but it must be emphasized that the occurrences are very rare, down to 4780'.

The pollen flora in the interval between the lowest occurrence of D. orthoteichus and the top occurrence of T. edwardsii resembles very much the results of Muller in Pecten -1A. In Nerita -1 the flora in the interval 2530'-3400' is identical to the flora in Pecten -1A in the samples 3338' and 3362' on account of high occurrences of Triorites harrisii (Po3.19), Malvacipollis diversus (Po5.69), Nothofagidites emarcida (Pco.39), and Myrtaceidites parvus (Pcs.41). Again as in Pecten -1A this interval is difficult to place in Harris' succession as the Triorites edwardsii-Duplopollis orthoteichus concurrent range zone, but following Muller it renders more likely a correlation of said interval with this transitional zone rather than with the Triorites edwardsii zone on account of Po5.69 (base occ. at 3200') and Pcs.41 (base occ. at 3400').

Below 3400' in Nerita -1 the same abundance of winged Conifer grains as Muller noticed in sample 3456' in Pecten -1A was noticed. These high occurrences range down to 4800' together with high occurrences of Pco.39 (Nothofagidites emarcida). Definite Cretaceous markers are not found, except for 2 specimens of Classopollis spec. in the sample 4730-40'. The three samples below 4730' revealed no Cretaceous markers. Therefore no top Cretaceous can be indicated.

The sporadic and low occurrences of microplankton in Nerita -1 may suggest a more continental origin of the sediments than in Pecten -1A.

Conclusion

It seems to be possible to correlate the pollen flora of Nerita -1 reasonably well with those of Pecten -1A and the land section in the Princetown area. Because, however, only cutting samples were available the results should be considered with caution and supplementary to results from sidewall samples.

References

COOKSON, I.C., 1954 : The occurrence of an older Tertiary microflora in Western Australia. Aust. J. Sci., 17 (1).

COOKSON, I.C. & PIKE, K., 1954 : Some dicotyledonous pollen types from Cainozoic deposits in the Australian region. Aust. J. Bot. 2 (2).

HARRIS, W.K., 1965 : Basal Tertiary microfloras from the Princetown area, Victoria, Australia. Palaeontographica, B, 115.

MULLER, J., September 1967 : Reporting on palynological results of the well Pecten -1A.

APPENDIX VIII

VELOCITY SURVEY NERITA -1

by

Geophysical Department
Shell Development (Australia) Pty. Ltd.

CONTENTS

1. INTRODUCTION

On the 1st August, 1967 a velocity survey was carried out by Western Geophysical Co. between 3250 and 6650 ft. in the Nerita No. 1 well. Before this survey could be carried out the owners of the Sedco 135 rig drilling the well, South Eastern Drilling Inc., placed restrictions on the amount of explosives that could be used at specific distances from the submerged pontoon footings of the semi-submersible rig. For the depth of submergence of these pontoons at Nerita, which was 75 ft., these restrictions were a maximum of 2 lbs. at 1000 ft., 10 lbs at 1500 ft. and 40 lbs at 2000 ft.

Prior to shooting it was considered that these restrictions might prevent the recording of good breaks by the well geophone. Fortunately in this survey this was not the case and a satisfactory well shoot was recorded.

2. INSTRUMENT SPECIFICATIONS

One GCE - 101 Pressure Sensitive Well Geophone.

One S.I.E. P - 11 Amplifier (12 channels) with input switching unit. Test Oscillator and Power Supply.

Two Battery Type 300 volt Blasters.

Three Kaar TR 327 Radios (C.B. Type)

Two RC - 5 Remote Control units for Shooters Radio.

Two RA - 12 Amplifier Units for Radio Time Break Recording.

Two PS - 2 Pressure Sensitive Hydrophones (Reference)

Portable Camera (12 trace)

Portable Developing System.

3. OPERATIONS

This was the first experience personnel from all the companies involv had in recording well shooting from a semi-submersible rig. Through the two days prior to the well shoot the stability of the vessel in spite of fairly strong winds (over 25 knots) was apparent. Movement of the drill stem relative to the marine riser was seldom more than one foot. This stability was helped by heavy rain falling throughout the night of the 31st July which flattened out the sea.

In recording from floating rigs it was Western's experience that the use of a T bar, resting on the top of the marine riser to which the well geophone cable was anchored, was necessary to reduce noise due to cable movement caused by the sea. In view of the stability of the Sedco 135 and the time involved in disconnecting the flow line and adjusting the slipjoint to allow a T bar to rest on the top of the marine riser, it was decided to proceed with the well shoot using only the Schlumberger compensator for sea movement. As the survey progressed the strong winds increased the sea swell and this could be seen in increased noise on the well geophone strings. Though fair to good breaks were recorded for all geophone positions except the 5,700 ft. level, nevertheless it is recommended that for any but very calm periods the T bar support be used.

Horizontal distances were obtained from the travel time of energy from the shot through the water to a reference geophone at the well location. On the day prior to the well shoot buoys were set at measured distances of 1000 ft., 1500 ft. and 2000 ft. from the pontoon footings but strong winds and current caused these to drift and become unreliable. Position was finally determined by coming in from about 3000 ft. using 5 lbs charges to assess distances, then setting a buoy at approximately 2,500 ft. and working from that. This proved quite practicable. Distances for the seven well shoot records varied from 2,205 to 2,370 feet.

Enclosure 1 shows the shooting position with respect to the anchor pattern for the rig.

Readings were taken for well geophone depths of 3,250, 4,000, 4,800, 5,700 and 6,650 ft. below derrick floor. Moving back up the hole repeat shots were made at the 5,700 and 3,250 ft. levels.

4. RESULTS OF SURVEY

Fair to good results were obtained for all positions of the well geophone except the 5,700 ft. level. The records are included as Enclosures 2 (1-9) of this report and Encl. 3 is the computation sheet for the survey. The resultant time-depth and velocity-depth graphs are shown in Encl.4 together with the plot of the sonic data. The linear velocity function $V_z = 5220 + 1.27z$ approximates very closely to the observed distribution.

Except for the reading from the geophone at total depth in the well, which is some 40 msecs. vertical reflection time too late, the velocity survey checks very closely with the integrated sonic times. No explanation can be put forward for the total depth value but it is considered the sonic plot gives a more reliable indication of the velocity depth relationship at this level. On the computation sheet (Encl.3) figures are given for breaks recorded from the initial 5 lbs. shots used for positioning. These give good vertical time agreement with the results from the heavier shooting at closer distances. This indicates that this area is one where energy transfer into the subsurface is very good.

Encl.5 is a copy of reflection V.A.R. section OD-66.74 across the Nerita structure intersecting the well location. The lithology encountered in the well has been inset into the section. Seismic horizon A does not correlate with a major lithological break but horizon B is very close to the top of the coal series in the upper part of the Eastern View Coal Meausres. The base of the coal series (approx. 4000 ft. subsea), correlates with the last fair reflection event (approx. 1.1 second).

The time-depth distribution used for the seismic interpretation is also indicated on Encl.4. This was slightly too fast down to 4,300 ft. and too slow for deeper events. Hence horizon B at the well location is about 70 ft. shallower than interpreted.

5. CONCLUSIONS

The well velocity survey has provided satisfactory calibration points for the sonic logs and has indicated that the velocity distribution used for time-depth conversion in earlier seismic surveys was acceptable.

In the case of Nerita No.1 the restrictions on charge size and distance imposed by Southeastern Drilling Inc. did not affect the results, but the area was clearly one of good energy transfer as exemplified by the data from the 5 lbs. positioning shots. The sea bed in the area consists of very soft to soft, plastic, interbedded clays and/or sand.

It is recommended that in future surveys in any but very calm periods a T bar resting on the top of the marine riser be used for anchoring the well geophone and thus reducing noise from rig movement caused by sea conditions.

WELL INFORMATION

Name of Well	Nerita No. 1
Date of Survey	August 1st, 1967
Location	15 miles offshore from Anglesea, Victoria in Petroleum Exploration Permit No. 22.
Co-Ordinates	Latitude 38° 37' 43.19" Longitude 144° 13' 44.83"
Elevation of Derrick Floor (Datum for Schlumberger logs)	112 ft. above Mean Sea Level
Total Depth of Well	6,700 ft. below derrick floor.
Casing Set	3,216 ft. below derrick floor.
Interval Surveyed	3250 to 6650 ft. below derrick floor

PERSONNEL AND STATISTICS

Shell Geophysicist	:	R. Smith
Western Operator	:	B.K. Potter
Western Shooter	:	N. Eastough
No. of Shots	:	9
No. of horizons surveyed	:	5
Time of first shot	:	09.17
Time of last shot	:	12.40
Total Explosives used	:	275 lbs.
Minimum charge size	:	5 lbs.
Maximum charge size	:	40 lbs.

PE902998

This is an enclosure indicator page.
The enclosure PE902998 is enclosed within the container PE900432 at this location in this document.

The enclosure PE902998 has the following characteristics:

ITEM_BARCODE	= PE902998
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 shooting plan
BASIN	= OTWAY
PERMIT	=
TYPE	= SEISMIC
SUBTYPE	= DIAGRAM
DESCRIPTION	= Nerita 1 Shooting Plan append VIII Encl.1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W508
WELL_NAME	= Nerita-1
CONTRACTOR	=
CLIENT_OP_CO	=

(Inserted by DNRE - Vic Govt Mines Dept)

PE602780

This is an enclosure indicator page.
The enclosure PE602780 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602780 has the following characteristics:

ITEM_BARCODE	= PE602780
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Well Velocity Survey (shot 1)
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Nerita 1 Well Velocity Survey (shot 1), Appendix 8, enclosure 2-1
REMARKS	= Appears the right edge has been cut off the original and the copy is of poor quality.
DATE_CREATED	= 31/08/67
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Shell Development (Australia) Pty. Ltd.
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE602781

This is an enclosure indicator page.
The enclosure PE602781 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602781 has the following characteristics:

ITEM_BARCODE	= PE602781
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Well Velocity Survey (shot 2)
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Nerita 1 Well Velocity Survey (shot 2), Appendix 8, enclosure 2-2
REMARKS	= Appears the right edge has been cut off the original and the copy is of poor quality.
DATE_CREATED	= 31/08/67
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Shell Development (Australia) Pty. Ltd.
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE602782

This is an enclosure indicator page.
The enclosure PE602782 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602782 has the following characteristics:

ITEM_BARCODE	= PE602782
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Well Velocity Survey (shot 3)
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Nerita 1 Well Velocity Survey (shot 3), Appendix 8, enclosure 2-3
REMARKS	= Appears the right edge has been cut off the original and the copy is of poor quality.
DATE_CREATED	= 31/08/67
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Shell Development (Australia) Pty. Ltd.
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE602783

This is an enclosure indicator page.
The enclosure PE602783 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602783 has the following characteristics:

ITEM_BARCODE	PE602783
CONTAINER_BARCODE	PE900432
NAME	Nerita 1 Well Velocity Survey (shot 4)
BASIN	Otway
PERMIT	PEP 22
TYPE	WELL
SUBTYPE	VELOCITY_CHART
DESCRIPTION	Nerita 1 Well Velocity Survey (shot 4), Appendix 8, enclosure 2-4
REMARKS	Appears the right edge has been cut off the original and the copy is of poor quality.
DATE_CREATED	31/08/67
DATE_RECEIVED	*
W_NO	W508
WELL_NAME	Nerita 1
CONTRACTOR	Shell Development (Australia) Pty. Ltd.
CLIENT_OP_CO	Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE602784

This is an enclosure indicator page.
The enclosure PE602784 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602784 has the following characteristics:

ITEM_BARCODE	= PE602784
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Well Velocity Survey (shot 5)
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Nerita 1 Well Velocity Survey (shot 5), Appendix 8, enclosure 2-5
REMARKS	= Appears the right edge has been cut off the original and the copy is of poor quality.
DATE_CREATED	= 31/08/67
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Shell Development (Australia) Pty. Ltd.
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE602785

This is an enclosure indicator page.
The enclosure PE602785 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602785 has the following characteristics:

ITEM_BARCODE	= PE602785
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Well Velocity Survey (shot 6)
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Nerita 1 Well Velocity Survey (shot 6), Appendix 8, enclosure 2-6
REMARKS	= Appears the right edge has been cut off the original and the copy is of poor quality.
DATE_CREATED	= 31/08/67
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Shell Development (Australia) Pty. Ltd.
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE602786

This is an enclosure indicator page.
The enclosure PE602786 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602786 has the following characteristics:

ITEM_BARCODE	= PE602786
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Well Velocity Survey (shot 7)
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Nerita 1 Well Velocity Survey (shot 7), Appendix 8, enclosure 2-7
REMARKS	= Appears the right edge has been cut off the original and the copy is of poor quality.
DATE_CREATED	= 31/08/67
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Shell Development (Australia) Pty. Ltd.
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE602787

This is an enclosure indicator page.
The enclosure PE602787 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602787 has the following characteristics:

ITEM_BARCODE	PE602787
CONTAINER_BARCODE	PE900432
NAME	Nerita 1 Well Velocity Survey (shot 8)
BASIN	Otway
PERMIT	PEP 22
TYPE	WELL
SUBTYPE	VELOCITY_CHART
DESCRIPTION	Nerita 1 Well Velocity Survey (shot 8), Appendix 8, enclosure 2-8
REMARKS	Appears the right edge has been cut off the original and the copy is of poor quality.
DATE_CREATED	31/08/67
DATE_RECEIVED	*
W_NO	W508
WELL_NAME	Nerita 1
CONTRACTOR	Shell Development (Australia) Pty. Ltd.
CLIENT_OP_CO	Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE602788

This is an enclosure indicator page.
The enclosure PE602788 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602788 has the following characteristics:

ITEM_BARCODE	= PE602788
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Well Velocity Survey (shot 9)
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Nerita 1 Well Velocity Survey (shot 9), Appendix 8, enclosure 2-9
REMARKS	= Appears the right edge has been cut off the original and the copy is of poor quality.
DATE_CREATED	= 31/08/67
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Shell Development (Australia) Pty. Ltd.
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE902996

This is an enclosure indicator page.
The enclosure PE902996 is enclosed within the container PE900432 at this location in this document.

The enclosure PE902996 has the following characteristics:

ITEM_BARCODE	= PE902996
CONTAINER_BARCODE	= PE900432
NAME	= Seismic acquisition data Nerita 1
BASIN	= OTWAY
PERMIT	=
TYPE	= SEISMIC
SUBTYPE	= ACQUSTN_RPT
DESCRIPTION	= Seismic acquisition data append VIII Encl. 3
REMARKS	=
DATE_CREATED	= 1/08/67
DATE_RECEIVED	=
W_NO	= W508
WELL_NAME	= Nerita-1
CONTRACTOR	= Western geophysical
CLIENT_OP_CO	= Shell Development (Australia) Pty Ltd

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PE902963

This is an enclosure indicator page.
The enclosure PE902963 is enclosed within the container PE900432 at this location in this document.

The enclosure PE902963 has the following characteristics:

ITEM_BARCODE	= PE902963
CONTAINER_BARCODE	= PE900432
NAME	= Time-depth and velocity - graphs Nerita 1
BASIN	= OTWAY
PERMIT	=
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= time-depth and velocity - graphs Nerita 1 appendix VIII encl. 4
REMARKS	=
DATE_CREATED	= 30/11/67
DATE_RECEIVED	=
W_NO	= W508
WELL_NAME	= Nerita-1
CONTRACTOR	= Shell Development (Australia) Pty Ltd
CLIENT_OP_CO	=

(Inserted by DNRE - Vic Govt Mines Dept)

PE602789

This is an enclosure indicator page.
The enclosure PE602789 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602789 has the following characteristics:

ITEM_BARCODE	= PE602789
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Seismic Line OD-66-74, SP 104-146D
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= SEISMIC
SUBTYPE	= SECTION
DESCRIPTION	= Nerita 1 Seismic Line OD-66-74, SP 104-146D
REMARKS	= *
DATE_CREATED	= 23/12/66
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Western Geophysical
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

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PE903042

This is an enclosure indicator page.
The enclosure PE903042 is enclosed within the container PE900432 at this location in this document.

The enclosure PE903042 has the following characteristics:

ITEM_BARCODE	= PE903042
CONTAINER_BARCODE	= PE900432
NAME	= Locality map showing regional geol. Nerita 1
BASIN	= OTWAY
PERMIT	=
TYPE	= WELL
SUBTYPE	= MAP
DESCRIPTION	= Locality Map showing Regional Geology of Southern Victoria and Bass Strait
REMARKS	=
DATE_CREATED	= 30/01/68
DATE_RECEIVED	=
W_NO	= W508
WELL_NAME	= Nerita-1
CONTRACTOR	= Shell Development (Australia) Pty Ltd
CLIENT_OP_CO	= Shell Development (Australia) Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE904287

This is an enclosure indicator page.
The enclosure PE904287 is enclosed within the container PE900432 at this location in this document.

The enclosure PE904287 has the following characteristics:

ITEM_BARCODE	PE904287
CONTAINER_BARCODE	PE900432
NAME	Nerita 1 Geological Section Before and After Drilling, Enclosure 2
BASIN	OTWAY
PERMIT	PEP 22
TYPE	WELL
SUBTYPE	CROSS_SECTION
DESCRIPTION	Nerita 1 Geological Section Before and After Drilling, Enclosure 2
REMARKS	
DATE_CREATED	1/11/67
DATE_RECEIVED	
W_NO	W508
WELL_NAME	Nerita 1
CONTRACTOR	*
CLIENT_OP_CO	*

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PE601570

This is an enclosure indicator page.
The enclosure PE601570 is enclosed within the container PE900432 at this location in this document.

The enclosure PE601570 has the following characteristics:

ITEM_BARCODE	= PE601570
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Composite Well Log (sheet 1)
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= COMPOSITE_LOG
DESCRIPTION	= Nerita 1 Composite Well Log (sheet 1), Enclosure 6
REMARKS	= *
DATE_CREATED	= 30/07/67
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Shell Development (Australia) Pty. Ltd.
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE601567

This is an enclosure indicator page.
The enclosure PE601567 is enclosed within the container PE900432 at this location in this document.

The enclosure PE601567 has the following characteristics:

ITEM_BARCODE	= PE601567
CONTAINER_BARCODE	= PE900432
NAME	= Composite Well log Nerita 1
BASIN	= OTWAY
PERMIT	= 22
TYPE	= WELL
SUBTYPE	= COMPOSITE_LOG
DESCRIPTION	= Composite Well Log - Nerita No.1 WCR Nerita Encl. 2
REMARKS	= Sheet 1 of 2
DATE_CREATED	= 20/05/05
DATE_RECEIVED	=
W_NO	= W508
WELL_NAME	= Nerita-1
CONTRACTOR	= Shell Development (Australia) Pty Ltd
CLIENT_OP_CO	= Shell Development (Australia) Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE601568

This is an enclosure indicator page.
The enclosure PE601568 is enclosed within the container PE900432 at this location in this document.

The enclosure PE601568 has the following characteristics:

ITEM_BARCODE	= PE601568
CONTAINER_BARCODE	= PE900432
NAME	= Composite Well log Nerita 1
BASIN	= OTWAY
PERMIT	=
TYPE	= WELL
SUBTYPE	= COMPOSITE_LOG
DESCRIPTION	= Composite Well Log - Nerita No.1 WCR Nerita Encl. 2
REMARKS	= Sheet 2 of 2
DATE_CREATED	= 20/05/05
DATE_RECEIVED	=
W_NO	= W508
WELL_NAME	= Nerita-1
CONTRACTOR	= Shell Development (Australia) Pty Ltd
CLIENT_OP_CO	= Shell Development (Australia) Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE902989

This is an enclosure indicator page.
The enclosure PE902989 is enclosed within the container PE900432 at this location in this document.

The enclosure PE902989 has the following characteristics:

ITEM_BARCODE	= PE902989
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 well history chart
BASIN	= OTWAY
PERMIT	=
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Nerita 1 - Well History Chart from WCR encl. 4
REMARKS	=
DATE_CREATED	= 30/11/67
DATE_RECEIVED	=
W_NO	= W508
WELL_NAME	= Nerita-1
CONTRACTOR	= Shell Development (Australia) Pty Ltd
CLIENT_OP_CO	= Shell Development (Australia) Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE902990

This is an enclosure indicator page.
The enclosure PE902990 is enclosed within the container PE900432 at this location in this document.

The enclosure PE902990 has the following characteristics:

ITEM_BARCODE	= PE902990
CONTAINER_BARCODE	= PE900432
NAME	= Well correlation Anglesea 1-Nerita 1
BASIN	= OTWAY
PERMIT	=
TYPE	= WELL
SUBTYPE	= CROSS_SECTION
DESCRIPTION	= Well Correlation Anglesea 1-Nerita 1 from WCR encl. 5
REMARKS	=
DATE_CREATED	= 30/11/67
DATE_RECEIVED	=
W_NO	= W508
WELL_NAME	= Nerita-1
CONTRACTOR	= Shell Development (Australia) Pty Ltd
CLIENT_OP_CO	= Shell Development (Australia) Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE602790

This is an enclosure indicator page.
The enclosure PE602790 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602790 has the following characteristics:

ITEM_BARCODE	= PE602790
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Master Log (Mud log), Page 1 of 7
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= MUD_LOG
DESCRIPTION	= Nerita 1 Master Log (Mud log), Page 1 of 7, 0 - 1000ft
REMARKS	= *
DATE_CREATED	= *
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Geoservices
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE602791

This is an enclosure indicator page.
The enclosure PE602791 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602791 has the following characteristics:

ITEM_BARCODE	= PE602791
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Master Log (Mud log), Page 2 of 7
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= MUD_LOG
DESCRIPTION	= Nerita 1 Master Log (Mud log), Page 2 of 7, 1000 - 2000ft
REMARKS	= *
DATE_CREATED	= *
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Geoservices
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE602792

This is an enclosure indicator page.
The enclosure PE602792 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602792 has the following characteristics:

ITEM_BARCODE	= PE602792
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Master Log (Mud log), Page 3 of 7
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= MUD_LOG
DESCRIPTION	= Nerita 1 Master Log (Mud log), Page 3 of 7, 2000 - 3000ft
REMARKS	= *
DATE_CREATED	= *
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Geoservices
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE602793

This is an enclosure indicator page.
The enclosure PE602793 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602793 has the following characteristics:

ITEM_BARCODE	= PE602793
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Master Log (Mud log), Page 4 of 7
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= MUD_LOG
DESCRIPTION	= Nerita 1 Master Log (Mud log), Page 4 of 7, 3000 - 4000ft
REMARKS	= *
DATE_CREATED	= *
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Geoservices
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE602794

This is an enclosure indicator page.
The enclosure PE602794 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602794 has the following characteristics:

ITEM_BARCODE	= PE602794
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Master Log (Mud log), Page 5 of 7
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= MUD_LOG
DESCRIPTION	= Nerita 1 Master Log (Mud log), Page 5 of 7, 4000 - 5000ft
REMARKS	= *
DATE_CREATED	= *
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Geoservices
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE602795

This is an enclosure indicator page.
The enclosure PE602795 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602795 has the following characteristics:

ITEM_BARCODE	= PE602795
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Master Log (Mud log), Page 6 of 7
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= MUD_LOG
DESCRIPTION	= Nerita 1 Master Log (Mud log), Page 6 of 7, 5000 - 6000ft
REMARKS	= *
DATE_CREATED	= *
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Geoservices
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)

PE602796

This is an enclosure indicator page.
The enclosure PE602796 is enclosed within the container PE900432 at this location in this document.

The enclosure PE602796 has the following characteristics:

ITEM_BARCODE	= PE602796
CONTAINER_BARCODE	= PE900432
NAME	= Nerita 1 Master Log (Mud log), Page 7 of 7
BASIN	= Otway
PERMIT	= PEP 22
TYPE	= WELL
SUBTYPE	= MUD_LOG
DESCRIPTION	= Nerita 1 Master Log (Mud log), Page 7 of 7, 6000 - 6700ft
REMARKS	= *
DATE_CREATED	= *
DATE_RECEIVED	= *
W_NO	= W508
WELL_NAME	= Nerita 1
CONTRACTOR	= Geoservices
CLIENT_OP_CO	= Shell Development (Australia) Pty. Ltd.

(Inserted by DNRE - Vic Govt Mines Dept)